

**NASA
Technical
Memorandum**

NASA TM-103530

**ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE
(STS-38) LAUNCH**

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Space Science Laboratory

February 1991

(NASA-TM-103530) ATMOSPHERIC ENVIRONMENT
FOR SPACE SHUTTLE (STS-38) LAUNCH (NASA)
44 p CSCL 13B

N91-21633

Unclass

G3/45 0005405



National Aeronautics and
Space Administration

George C. Marshall Space Flight Center

1. Report No. NASA TM-103530		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Atmospheric Environment for Space Shuttle (STS-38) Launch				5. Report Date February 1991	
				6. Performing Organization Code	
7. Author(s) G.L. Jasper and G.W. Batts*				8. Performing Organization Report No.	
				10. Work Unit No.	
9. Performing Organization Name and Address George C. Marshall Space Flight Center Marshall Space Flight Center, Alabama 35812				11. Contract or Grant No.	
				13. Type of Report and Period Covered Technical Memorandum	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546				14. Sponsoring Agency Code	
15. Supplementary Notes Prepared by Space Science Laboratory, Science and Engineering Directorate. *New Technology Incorporated, Huntsville, Alabama.					
16. Abstract This report presents a summary of selected atmospheric conditions observed near space shuttle STS-38 launch time on November 15, 1990, at Kennedy Space Center, Florida. STS-38 carried a Department of Defense payload and the flight azimuth in this report will be denoted by a reference flight azimuth, since the actual flight azimuth is not known. Values of ambient pressure, temperature, moisture, ground winds, visual observations (cloud), and winds aloft are included. The sequence of prelaunch Jimsphere-measured vertical wind profiles is given in this report. The final atmospheric tape, which consists of wind and thermodynamic parameters versus altitude, for STS-38 vehicle ascent has been constructed. The STS-38 ascent atmospheric data tape has been constructed by Marshall Space Flight Center's Earth Science and Applications Division to provide an internally consistent data set for use in postflight performance assessments and represents the best estimate of the launch environment to the 400,000-ft altitude that was traversed by the STS-38 vehicle.					
17. Key Words (Suggested by Author(s)) STS-38 Launch Atmospheric Summary Pressure, Temperature, Relative Humidity Winds, Winds Aloft, Clouds Space Shuttle				18. Distribution Statement Unclassified - Unlimited	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified		21. No. of pages 44	22. Price NTIS	

ACKNOWLEDGMENTS

The authors wish to thank the personnel of NASA Kennedy Space Center (KSC), along with those at the Cape Canaveral Air Force Station and their Computer Sciences Raytheon contractors, for the acquisition and distribution of all related KSC atmospheric data received at MSFC.

Thanks are due to Calvin Prather and Janice Bijvoet of Sverdrup Technology Inc. for their help in extracting atmospheric data that are used in this report. Appreciation is also expressed to Kimberly Wilkie of NTI for the computer support in attaining pad measurements.

TABLE OF CONTENTS

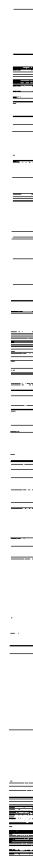
	Page
I. INTRODUCTION	1
II. SOURCES OF DATA	1
III. GENERAL SYNOPTIC SITUATION AT LAUNCH TIME	2
IV. SURFACE OBSERVATIONS AT LAUNCH TIME	2
V. UPPER AIR MEASUREMENTS DURING LAUNCH	2
A. Wind Speed	2
B. Wind Direction	3
C. Prelaunch/Launch Wind Profiles	3
D. Thermodynamic Data	3
E. SRB Upper Air and Surface Measurements	3
REFERENCES	35

LIST OF ILLUSTRATIONS

Figure	Title	Page
1.	Surface synoptic chart 11 h 48 min before the launch of STS-38	25
2.	500-mb map 11 h 48 min before the launch of STS-38.....	26
3.	GOES-7 infrared imagery of cloud cover 2 min before the launch of STS-38 (2346 u.t., November 15, 1990). 500-mb heights (meters) and wind barbs are also included for 0000 u.t. November 16, 1990	27
4.	Enlarged view of GOES-7 infrared imagery of cloud cover taken 2 min before the launch of STS-38 (2346 u.t., November 15, 1990). Surface temperatures, isobaric parameters, and wind barbs for 0000 u.t. November 16, 1990, are also included	28
5.	Scalar wind speed and direction at launch time of STS-38.....	29
6.	STS-38 prelaunch/launch Jimsphere-measured wind speeds (ft/s)	30
7.	STS-38 prelaunch/launch Jimsphere-measured wind directions (degrees)	31
8.	STS-38 prelaunch/launch Jimsphere-measured in-plane component winds (ft/s). Reference flight azimuth = 90 degrees	32
9.	STS-38 prelaunch/launch Jimsphere-measured out-of-plane component winds (ft/s). Reference flight azimuth = 90 degrees	33
10.	STS-38 temperature profiles versus altitude for launch (ascent)	34

LIST OF TABLES

Table	Title	Page
1.	Selected atmospheric observations for the flights of the space shuttle vehicles	4
2.	Systems used to measure upper air wind data for STS-38 ascent	7
3.	KSC surface observations at STS-38 launch time	8
4.	STS-38 pre-launch through launch KSC pad 39A atmospheric measurements	9
5.	STS-38 ascent atmospheric data tape	10



TECHNICAL MEMORANDUM

ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE (STS-38) LAUNCH

I. INTRODUCTION

This report presents an evaluation of the atmospheric environmental data taken during the launch of the space shuttle/STS-38 vehicle. This space shuttle vehicle was launched from pad 39A at Kennedy Space Center (KSC), Florida, on a reference bearing of 90-degrees east of north, at 2348 u.t. (1848 e.s.t.) on November 15, 1990.

This report presents a summary of the atmospheric environment at launch time ($L+0$) of the STS-38, together with the sequence of prelaunch Jimsphere-measured winds aloft profiles from $L-3.30$ h through liftoff. The general atmospheric situation for the launch and flight area is described, and surface and upper level wind/thermodynamic observations near launch time are given. Since a ship was unavailable for STS-38 duty, the solid rocket booster (SRB) descent/impact atmospheric data were not taken. However, one can use the STS-38 ascent data for SRB studies as the best substitute.

Previous MSFC-related launch vehicle atmospheric environmental conditions have been published as appendix A of individual MSFC Saturn Flight Evaluation Working Group reports [1]. Office memorandums have been issued for previous flights giving launch pad wind information. A report has also been published [2] which summarizes most launch atmospheric conditions observed for the past 155 MSFC/ABMA-related vehicle launches through SA-208 (Skylab 4). Reports summarizing ASTP, STS-1 through STS-41 launch conditions are presented in references 3 through 32, respectively. Table 1 gives the atmospheric $L+0$ launch conditions for all the space shuttle missions.

II. SOURCES OF DATA

Atmospheric observational data used in this report were taken from synoptic maps made by the National Weather Service, plus all available surface observations and measurements from around the launch area. Upper air observations were taken from balloon-released instruments sent aloft from Cape Canaveral Air Force Station (CCAFS). High-altitude winds and thermodynamic data were generated by the Global Reference Atmospheric Model (GRAM) since there was no reliable Super-Loki rocketsonde data. Table 2 presents a listing of systems used to obtain the upper level wind profiles used in compiling the final ascent atmospheric data tape. Data cutoff altitudes are also given in table 2.

III. GENERAL SYNOPTIC SITUATION AT LAUNCH TIME

A massive area of high pressure prevailed over the southeast portion of the United States during the liftoff of STS-38. Surface winds were moderate and easterly over Cape Kennedy just prior to the launch time. Figure 1 shows the surface map 11 h 48 min after the launch of STS-38. Westerly winds dominated the flow aloft over the KSC region. Figure 2 presents the winds aloft condition at the 500-mb level 11 h 48 min before launch.

Scattered clouds were over the launch area prior to and during the launch of STS-38. Figure 3 depicts the GOES-7 infrared satellite picture at 2346 u.t. (2 min before liftoff) with 500-mb heights denoted in meters and wind barbs superimposed. Figure 4 gives an up-close infrared shot of the Florida peninsula as recorded by GOES-7, also taken at 2346 u.t. with surface temperatures, wind barbs, and pressure superimposed.

IV. SURFACE OBSERVATIONS AT LAUNCH TIME

Surface observations at launch time for selected KSC locations are given in table 3. Included are pad 39A, shuttle runway, and CCAFS balloon release station observations. Neither precipitation nor lightning was observed at launch time.

Table 4 presents pad 39A wind data along with other standard hourly atmospheric measurements and sky observations for the 6-h period prior to launch of STS-38. Values for wind speed and direction are given for the 18-m (60-ft) pad light pole level.

V. UPPER AIR MEASUREMENTS DURING LAUNCH

The FPS-16 Jimsphere (0003 u.t.) and the MSS Rawinsonde (2316 u.t.) systems were used to measure the upper level wind and thermodynamic parameters for STS-38 launch. At altitudes above the measured data, the GRAM [33] parameters for December KSC conditions were used. A tabulation of the STS-38 final atmospheric data for ascent is presented in table 5 which lists the wind and thermodynamic parameters versus altitude. A brief summary of parameters is given in the following paragraphs.

A. Wind Speed

At launch time, wind speeds were 28.7 ft/s (17.0 kn) at the 60-ft level and increased to a maximum of 38.4 ft/s (64.9 kn) at 2,200 ft (671 m). The winds decreased above this level and began increasing consistently at the 19,700-ft (6,005-m) level. The maximum wind speed above this altitude was 147.6 ft/s (249.3 kn) at 41,500 ft (12,649 m). Winds generally decreased above this altitude throughout 100,000 ft (30,480 m) which was the last measurable wind speed level.

B. Wind Direction

At launch time, the 60-ft wind direction was from the east and gradually shifted to a southerly direction at 9,700 ft (2,957 m). Winds maintained a southerly component until the 15,000-ft (4,572-m) altitude where they took on a westerly component. The winds maintained a westerly direction throughout the 67,000-ft (20,422-m) level and became northerly above this altitude. The winds continued northerly throughout 100,000 ft (30,480 m) which was the last measurable wind direction altitude.

C. Prelaunch/Launch Wind Profiles

Prelaunch/launch wind profiles given in figures 6 through 9 were measured by the Jimsphere FPS-16 system. Data are shown for four measurement periods beginning at L-3.30 h and extending through L + 15 min.

The wind speed and direction profiles for the 3.30-h period prior to and including L + 15 min are shown in figures 6 and 7. The in-plane (head-tail wind) and out-of-plane (left-right crosswind) profiles are given in figures 8 and 9. The in-plane component wind speeds were greater than the December mean head wind component values at all altitudes with the exception of the 35 to 45,000-ft layer where the in-plane wind component wind speeds were less than the December mean tail wind component values. The out-of-plane wind component wind speeds below 20,000 ft were greater than the December mean wind right crosswind values. Above 20,000 ft the out-of-plane wind component wind speeds were less than the December mean left crosswind values.

D. Thermodynamic Data

The thermodynamic data, taken at STS-38 launch time, consisted of atmospheric temperature, dew-point temperature, pressure, and density. These data have been compiled as the STS-38 ascent atmospheric data and are presented in table 5. Missing data is indicated by -9999.00 in table 5. The vertical structure of temperature and dew-point temperature for STS-38 ascent are shown graphically versus altitude in figure 10.

E. SRB Upper Air and Surface Measurements

As has been mentioned in the introduction, since there was no ship available, an SRB descent atmospheric data tape has not been constructed. The tabular values for the ascent atmospheric tape, as presented in table 5, should be used for SRB descent/impact studies since it is the closest measured data source.

Table 1. Selected atmospheric observations for the flights of the space shuttle vehicles.

Vehicle Data ^h				Surface Observations				Inflight Conditions Max. Wind Below 60,000 ft			Count Down and Launch Comments of Meteorological Significance
Seq. No.	Vehicle No.	Launch Date	Time (EST) Nearest Minute	Thermodynamic ^a		Wind ^b		Alt. (ft)	Speed (ft/s)	Dir. (°)	
				Press. ^c N/cm ²	Temp. ^c (°C)	Rel. Hum. (%)	Speed (ft/s)	Dir. (°)			
1	STS-1 Columbia	4/12/81	0700	10.234 ^d	21	82	11.8 15.2	125 120	44,300	98	250
2	STS-2 Columbia	11/12/81	1010	10.166	23	61	27.0 27.0	345 355	36,300	158	286
3	STS-3 Columbia	3/22/82	1100	10.160	24	71	7.0 ^e 8.0 ^e	50 ^e 145 ^e	45,000	119	250
4	STS-4 Columbia	6/27/82	1100 ^f	10.200	29	70	5.8 ^g 4.9 ^g	133 ^g 141 ^g	47,900	37	329
5	STS-5 Columbia	11/11/82	0719	10.227	22	68	22.0 35.0	90 90	40,600	146	336
6	STS-6 Challenger	4/4/83	1330	10.183	23	55	12.7 16.4	63 55	46,100	155	277
7	STS-7 Challenger	6/18/83	0733 ^f	10.146	25	80	5.9 ^e 10.3 ^e	10 ^e 350 ^a	45,900	76	278
8	STS-8 Challenger	8/30/83	0232 ^f	10.111	24	97	8.8 14.0	269 268	45,100	30	349
9	STS-9 (SL-1) Columbia	11/28/83	1100	10.153	24	83	19.1 32.0	183 190	47,100	117	252
10	STS-11 (41-B) Challenger	2/3/84	0800	10.173	17	75	0.0 NA	0 NA	38,200	143	288
11	STS-13 (41-C) Challenger	4/6/84	0858	10.149	16	56	21.5 18.6	320 275	37,700	176	289
12	STS-41D Discovery	8/30/84	0842 ^f	10.172	26	81	3.0 3.6	106 39	40,300	44	270
13	STS-41G Challenger	10/5/84	0703 ^f	10.210	23	60	16.5 14.8	73 58	40,600	78	303
14	STS-51A Discovery	11/8/84	0715	10.227	20	59	23.0 31.1	24 10	33,100	131	272
15	STS-51C Discovery	1/24/85	1450	10.173	18	46	17.1 15.5	228 253	42,900	199	265

17-min countdown delay due to adverse weather conditions.

1-day delay due to excessive wind loads, calculated at high altitudes.

1-day delay due to extreme cold surface temperatures.

Table 1. Selected atmospheric observations for the flights of the space shuttle vehicles (continued).

Vehicle Data ^h			Surface Observations					Inflight Conditions Max. Wind Below 60,000 ft			Count Down and Launch Comments of Meteorological Significance
Seq. No.	Vehicle No.	Launch Date	Time (EST) Nearest Minute	Thermodynamic ^a		Wind ^b		Alt. (ft)	Speed (ft/s)	Dir. (°)	
				Press. N/cm ²	Temp. (°C)	Rel. Hum. (%)	Speed (ft/s)	Dir. (°)			
16	STS-51D Discovery	4/12/85	1359	10.257	21	55	19.9 22.3	82 82	42,600	134	265
17	STS-51B Challenger	4/29/85	1202 ^f	10.128	27	65	11.5 18.4	005 337	32,900 40,700	68 68	320 297
18	STS-51G Discovery	6/17/85	0733 ^f	10.201	23	91	2.9 11.8	201 206	40,100 46,700	55 55	298 302
19	STS-51F Challenger	7/29/85	1700 ^f	10.174	28	72	14.9 13.4	101 113	48,000	53	035
20	STS-51I Discovery	8/27/85	0658 ^f	10.225	24	86	14.2 16.6	073 070	41,000	43	123
21	STS-51J Atlantis	10/3/85	1115 ^f	10.185	28	79	17.0 13.7	213 171	48,000	48	283
22	STS-61A Challenger	10/30/85	1200	10.059	28	72	12.7 14.1	217 174	43,000	81	218
23	STS-61B Atlantis	11/26/85	1929	10.202	23	81	10.1 10.4	165 112	49,300	75	270
24	STS-61C Columbia	1/12/86	0655	10.206	12	84	15.4 18.6	323 342	40,000	221	263
25 ^j	STS-51L ⁱ Challenger	1/28/86	1138	10.253	3	27	20.1 15.3	331 262	42,000	174	264
26 ^j	STS-26 Discovery	9/29/88	1137 ^f	10.182	29	56	13.7 13.5	058 047	53,100	44	304
27 ^j	STS-27 Atlantis	12/2/88	930	10.270	14	50	25.5 22.0	314 352	40,200	187	245
28 ^j	STS-29 Discovery	3/13/89	957	10.190	18	78	16.9	242	45,200	105	283
29 ^j	STS-30 Atlantis	5/4/89	1437 ^f	10.200	26	57	21.6	106	44,200	157	255

(20) 8/24 launch scrub due to unacceptable weather in launch area. Rain during countdown.

(24) 1/7 launch scrub due to unacceptable weather at TAW sites. 1/10 launch scrub due to heavy rain in launch area.

(25) 1/26 launch scrub due in part to potential bad weather associated with frontal passage. 1/27 launch scrub due in part to strong cross winds at X68. 1/28 2-hr delay due in part to cold early morning temps.

(26) 1-hr and 37-min delay due to light winds.

(27) 1-day delay due to excessive wind loads, calculated at high altitudes.

(28) 2-hr delay due to fog and strong winds aloft.

(29) 59-min delay due to cloud cover over the launch area.

Table 1. Selected atmospheric observations for the flights of the space shuttle vehicles (continued).

Vehicle Data ^h				Surface Observations				Inflight Conditions Max. Wind Below 60,000 ft			Count Down and Launch Comments of Meteorological Significance	
				Thermodynamic ^a		Wind ^b						
				Seq. No.	Vehicle No.	Launch Date	Time (EST) Nearest Minute	Press. N/cm ²	Temp. (°C)	Rel. Hum. (%)		Speed (ft/s)
30 ^j	STS-28 Columbia	8/8/89	0837 ^f	10.120	27	80	12.5	252	24,100	35	286	
31 ^j	STS-34 Atlantis	10/18/89	1254 ^f	10.152	30	52	13.5	193	45,800 47,100	61 61	287 294	
32 ^j	STS-33 Discovery	11/22/89	1924	10.132	19	80	16.9	208	41,900	110	237	
33	STS-32 Columbia	1/9/90	0735	10.194	12	100	6.8	246	43,800	160	242	
34	STS-36 Atlantis	2/28/90	0250	10.268	18	71	23.6	72	41,600	177	289	
35 ^j	STS-31 Discovery	4/24/90	0834 ^f	10.186	22	63	18.6	80	31,300	96	307	
36 ^j	STS-41 Discovery	10/6/90	0747 ^f	10.176	27	73	23.6	90	41,300	86	293	
37	STS-38 Atlantis	11/15/90	1948	10.254	21	63	28.7	84	41,500	148	273	

a. Pad 39A thermodynamic measurements taken at approximately 1.2 m (4 ft) above natural grade at camera site No. 3.

b. 1-min average prior to L+0 of 60-ft PLP winds measured above natural grade. 275-ft FSS wind measurements were not available after sequence No. 27.

c. Pressure measurement applicable to 21 ft above MSL unless otherwise indicated.

d. Pressure measurement applicable to 14 ft above MSL.

e. 10-sec average prior to L+0.

f. Eastern daylight time.

g. 30-sec average prior to L+0.

h. All vehicles launched from LC 39A except where noted.

i. Shuttle exploded in flight.

j. Vehicle launched from 39B.

31) 1 day delay due to rain showers in launch area.

33) 1-day delay due to cloud cover over the launch area.

34) 6-day delay due to crew illness and various weather conditions.

35) 2-week delay due to failure of an auxiliary power unit.

Table 2. Systems used to measure upper air wind data for STS-38 ascent.

Type of Data	Date: November 15, 1990		Portion of Data Used			
	Release Time		Start		End	
	Time (u.t.) (h:min)	Time After L+0 (min)	Altitude m (ft)	Time After L+0 (min)	Altitude m (ft)	Time After L+0 (min)
FPS-16 Jimsphere	00:03 (Nov. 16, 1990)	15	6 (21)	15	17,069 (56,000)	71
MSS Rawinsonde	23:16	-32	16,459 (56,000)	24	30,480 (100,000)	68

Table 3. KSC surface observations at STS-38 launch time.

Location ^a	Time After L+0 (min)	Pressure (MSL) N/cm ² (psia)	Temperature K (°F)	Dew Point K (°F)	Relative Humidity (%)	Visibility km (miles)	Sky Cover*			Wind	
							Cloud Amount	Cloud Type	Height of Base Meters (ft)	Speed ft/s (kt)	Direction (°)
NASA Space Shuttle Runway X68e Winds Measured at 10.4 m (34 ft)	0	10.257 (14.877)	295.9 (73.0)	288.7 (60.0)	64	16 (10)	1	Stratocumulus	1,219 (4,000)	20.3 (12.0)	100
CCAFS XMR ^c Surface Measurements	0	10.260 (14.881)	293.7 (69.0)	288.2 (59.0)	71	16 (10)	1	Alto cumulus	2,134 (7,000)	10.1 (6.0)	090
Pad 39A ^d Lightpole ^b SE 18.3 m (60.0 ft)	0	10.254 (14.872)	294.3 (70.0)	286.9 (57.0)	63	-	-	-	-	28.7 (17.0)	084

*1/10 total sky cover at X68 and 2/10 total sky cover at XMR.

- a. Altitudes of measurements are above natural grade, except where noted.
b. Approximately 1-min average prior to L+0.
c. Balloon release site.
d. Pad 39A thermodynamic measurements are taken at camera site No. 3, approximately 6.4 m (21 ft) above MSL.
e. Official STS-38 sky observational site.

Table 4. STS-38 prelaunch through launch KSC pad 39A atmospheric measurements.^a

Hourly Atmospheric Measurements ^a						Sky Condition ^b			
15 November 1990 Time u.t.	Temperature (°F)	Dew Point (°F)	Relative Humidity (%)	60' Level (SE)		Clouds	Total Sky Cover	Vis. (mi.)	Other Remarks
				WS Kt	WD°				
1800	76	62	62	13	102	Scattered at 4,000 and 7,500 ft	2/10	10	
1900	77	63	62	15	089	Scattered at 4,100 and 7,500 ft	2/10	10	
2000	77	63	62	15	082	Scattered at 4,200 and 7,500 ft	2/10	10	
2100	76	61	60	15	090	Scattered at 4,300 and 7,500 ft	1/10	10	
2200	75	61	61	17	091	Scattered at 4,400 and 7,000 ft	1/10	10	
2300	75	60	60	14	095	Scattered at 4,500 and 7,000 ft	1/10	10	
L+0 ^c 2348	70	57	63	17	084	Scattered at 5,000 and 7,000 ft	1/10	10	

a. Hourly pad observations (obtained via MSFC/HOSC) averaged over 5 min, centered on the hour.

b. Sky observations taken at the shuttle runway site X68.

c. L+0 PAD wind and thermodynamic parameters obtained from HOSC strip charts. The SE anemometer was used at the 60-ft level for L+0 wind conditions (approximately 1 min average prior to L+0).

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Table 5. STS-38 ascent atmospheric data tape.

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
21.	28.71	84.00	21.10	0.1025E+04	0.1206E+04	13.80
100.	20.34	98.00	21.10	0.1022E+04	0.1203E+04	13.80
200.	23.95	92.00	21.10	0.1019E+04	0.1199E+04	13.80
300.	27.23	90.00	21.10	0.1015E+04	0.1195E+04	13.80
400.	30.84	87.00	21.10	0.1012E+04	0.1191E+04	13.80
500.	34.12	85.00	21.10	0.1008E+04	0.1186E+04	13.80
600.	37.07	82.00	21.11	0.1005E+04	0.1182E+04	13.81
700.	35.43	81.00	21.11	0.1001E+04	0.1178E+04	13.81
800.	35.43	82.00	21.11	0.9976E+03	0.1174E+04	13.81
900.	35.10	84.00	21.11	0.9941E+03	0.1170E+04	13.81
1000.	34.78	85.00	21.11	0.9907E+03	0.1166E+04	13.81
1100.	35.76	89.00	20.80	0.9872E+03	0.1163E+04	13.73
1200.	36.75	90.00	20.49	0.9837E+03	0.1160E+04	13.65
1300.	36.09	91.00	20.18	0.9803E+03	0.1157E+04	13.57
1400.	35.76	89.00	19.87	0.9768E+03	0.1154E+04	13.49
1500.	35.43	89.00	19.56	0.9733E+03	0.1151E+04	13.41
1600.	36.09	92.00	19.25	0.9699E+03	0.1149E+04	13.33
1700.	36.75	89.00	18.94	0.9665E+03	0.1146E+04	13.25
1800.	37.07	90.00	18.63	0.9631E+03	0.1143E+04	13.17
1900.	38.06	90.00	18.32	0.9597E+03	0.1140E+04	13.09
2000.	36.75	86.00	18.01	0.9563E+03	0.1137E+04	13.01
2100.	37.40	92.00	17.69	0.9529E+03	0.1135E+04	12.84
2200.	38.39	93.00	17.37	0.9495E+03	0.1132E+04	12.67
2300.	35.76	87.00	17.05	0.9461E+03	0.1129E+04	12.50
2400.	29.86	93.00	16.73	0.9428E+03	0.1126E+04	12.33
2500.	29.86	92.00	16.41	0.9394E+03	0.1124E+04	12.16
2600.	29.53	88.00	16.09	0.9361E+03	0.1121E+04	11.99
2700.	31.17	84.00	15.77	0.9327E+03	0.1118E+04	11.82
2800.	31.82	87.00	15.45	0.9294E+03	0.1116E+04	11.65
2900.	30.18	84.00	15.13	0.9261E+03	0.1113E+04	11.48
3000.	29.20	88.00	14.81	0.9228E+03	0.1110E+04	11.31
3100.	29.20	87.00	14.61	0.9195E+03	0.1107E+04	10.95
3200.	28.87	85.00	14.41	0.9162E+03	0.1104E+04	10.59
3300.	28.54	92.00	14.21	0.9129E+03	0.1101E+04	10.23
3400.	25.92	89.00	14.01	0.9096E+03	0.1098E+04	9.87
3500.	23.95	84.00	13.81	0.9064E+03	0.1095E+04	9.51
3600.	24.61	90.00	13.61	0.9031E+03	0.1092E+04	9.15
3700.	27.56	86.00	13.41	0.8999E+03	0.1089E+04	8.79
3800.	29.53	82.00	13.21	0.8966E+03	0.1086E+04	8.43
3900.	27.23	86.00	13.01	0.8934E+03	0.1083E+04	8.07
4000.	28.22	90.00	12.81	0.8902E+03	0.1080E+04	7.71
4100.	27.89	83.00	12.59	0.8870E+03	0.1077E+04	7.49
4200.	28.22	89.00	12.37	0.8837E+03	0.1074E+04	7.27
4300.	29.86	93.00	12.15	0.8805E+03	0.1071E+04	7.05
4400.	31.82	89.00	11.93	0.8773E+03	0.1068E+04	6.83
4500.	30.18	89.00	11.71	0.8742E+03	0.1065E+04	6.61
4600.	26.25	95.00	11.49	0.8710E+03	0.1062E+04	6.39
4700.	30.18	94.00	11.27	0.8678E+03	0.1059E+04	6.17
4800.	30.18	89.00	11.05	0.8647E+03	0.1056E+04	5.95
4900.	27.23	93.00	10.83	0.8615E+03	0.1053E+04	5.73

Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
5000.	29.53	98.00	10.61	0.8584E+03	0.1050E+04	5.51
5100.	30.18	97.00	10.36	0.8553E+03	0.1047E+04	5.33
5200.	27.89	93.00	10.11	0.8521E+03	0.1044E+04	5.15
5300.	25.92	92.00	9.86	0.8490E+03	0.1041E+04	4.97
5400.	27.89	96.00	9.61	0.8459E+03	0.1038E+04	4.79
5500.	25.26	94.00	9.36	0.8429E+03	0.1035E+04	4.61
5600.	26.25	95.00	9.11	0.8398E+03	0.1033E+04	4.43
5700.	26.57	93.00	8.86	0.8367E+03	0.1030E+04	4.25
5800.	27.56	96.00	8.61	0.8337E+03	0.1027E+04	4.07
5900.	27.89	89.00	8.36	0.8306E+03	0.1024E+04	3.89
6000.	25.26	91.00	8.11	0.8276E+03	0.1021E+04	3.71
6100.	26.57	95.00	7.89	0.8245E+03	0.1018E+04	3.45
6200.	24.93	85.00	7.67	0.8215E+03	0.1015E+04	3.19
6300.	20.67	95.00	7.45	0.8185E+03	0.1013E+04	2.93
6400.	22.97	102.00	7.23	0.8154E+03	0.1010E+04	2.67
6500.	21.00	90.00	7.01	0.8124E+03	0.1007E+04	2.41
6600.	19.03	89.00	6.70	0.8094E+03	0.1004E+04	2.15
6700.	16.73	94.00	6.57	0.8064E+03	0.1001E+04	1.89
6800.	17.06	101.00	6.35	0.8034E+03	0.9981E+03	1.63
6900.	19.69	95.00	6.13	0.8005E+03	0.9953E+03	1.37
7000.	19.36	90.00	5.91	0.7975E+03	0.9924E+03	1.11
7100.	16.40	89.00	6.01	0.7946E+03	0.9887E+03	-0.04
7200.	16.73	97.00	6.11	0.7916E+03	0.9849E+03	-1.19
7300.	19.03	100.00	6.21	0.7887E+03	0.9811E+03	-2.34
7400.	20.01	88.00	6.31	0.7858E+03	0.9773E+03	-3.49
7500.	15.42	91.00	6.41	0.7829E+03	0.9735E+03	-4.64
7600.	16.40	98.00	6.51	0.7800E+03	0.9697E+03	-5.79
7700.	21.33	96.00	6.61	0.7771E+03	0.9659E+03	-6.94
7800.	21.65	94.00	6.71	0.7742E+03	0.9622E+03	-8.09
7900.	21.00	102.00	6.81	0.7714E+03	0.9584E+03	-9.24
8000.	22.31	109.00	6.91	0.7685E+03	0.9546E+03	-10.39
8100.	20.01	102.00	7.03	0.7657E+03	0.9507E+03	-10.52
8200.	21.00	110.00	7.15	0.7629E+03	0.9468E+03	-10.65
8300.	23.95	116.00	7.27	0.7601E+03	0.9430E+03	-10.78
8400.	21.98	114.00	7.39	0.7573E+03	0.9391E+03	-10.91
8500.	19.69	112.00	7.51	0.7545E+03	0.9352E+03	-11.04
8600.	21.98	113.00	7.63	0.7517E+03	0.9314E+03	-11.17
8700.	20.01	114.00	7.75	0.7489E+03	0.9276E+03	-11.30
8800.	19.03	119.00	7.87	0.7462E+03	0.9238E+03	-11.43
8900.	20.01	113.00	7.99	0.7434E+03	0.9200E+03	-11.56
9000.	15.75	110.00	8.11	0.7407E+03	0.9163E+03	-11.69
9100.	14.44	116.00	8.09	0.7380E+03	0.9130E+03	-11.94
9200.	14.76	113.00	8.07	0.7352E+03	0.9097E+03	-12.19
9300.	10.83	121.00	8.05	0.7325E+03	0.9064E+03	-12.44
9400.	10.50	142.00	8.03	0.7298E+03	0.9031E+03	-12.69
9500.	9.84	140.00	8.01	0.7271E+03	0.8999E+03	-12.94
9600.	4.59	145.00	7.99	0.7244E+03	0.8966E+03	-13.19
9700.	5.25	175.00	7.97	0.7218E+03	0.8934E+03	-13.44
9800.	4.92	174.00	7.95	0.7191E+03	0.8902E+03	-13.69
9900.	5.25	205.00	7.93	0.7164E+03	0.8870E+03	-13.94

Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
10000.	4.59	198.00	7.91	0.7138E+03	0.8838E+03	-14.19
10100.	5.25	182.00	7.82	0.7112E+03	0.8808E+03	-14.31
10200.	3.94	184.00	7.73	0.7085E+03	0.8778E+03	-14.43
10300.	6.89	191.00	7.64	0.7059E+03	0.8749E+03	-14.55
10400.	8.86	169.00	7.55	0.7033E+03	0.8720E+03	-14.67
10500.	6.56	157.00	7.46	0.7007E+03	0.8690E+03	-14.79
10600.	6.89	173.00	7.37	0.6981E+03	0.8661E+03	-14.91
10700.	9.19	169.00	7.28	0.6956E+03	0.8632E+03	-15.03
10800.	6.89	159.00	7.19	0.6930E+03	0.8603E+03	-15.15
10900.	6.23	163.00	7.10	0.6904E+03	0.8574E+03	-15.27
11000.	8.20	160.00	7.01	0.6879E+03	0.8545E+03	-15.39
11100.	5.58	157.00	6.85	0.6854E+03	0.8518E+03	-15.51
11200.	6.56	168.00	6.69	0.6828E+03	0.8492E+03	-15.63
11300.	8.86	154.00	6.53	0.6803E+03	0.8465E+03	-15.75
11400.	6.56	158.00	6.37	0.6778E+03	0.8439E+03	-15.87
11500.	6.23	178.00	6.21	0.6753E+03	0.8413E+03	-15.99
11600.	8.86	166.00	6.05	0.6728E+03	0.8386E+03	-16.11
11700.	8.86	150.00	5.89	0.6703E+03	0.8360E+03	-16.23
11800.	12.14	161.00	5.73	0.6678E+03	0.8334E+03	-16.35
11900.	11.81	165.00	5.57	0.6654E+03	0.8308E+03	-16.47
12000.	11.48	159.00	5.41	0.6629E+03	0.8282E+03	-16.59
12100.	16.08	166.00	5.32	0.6604E+03	0.8254E+03	-16.68
12200.	16.73	162.00	5.23	0.6580E+03	0.8226E+03	-16.77
12300.	15.42	156.00	5.14	0.6555E+03	0.8198E+03	-16.86
12400.	17.06	156.00	5.05	0.6531E+03	0.8170E+03	-16.95
12500.	17.72	160.00	4.96	0.6506E+03	0.8142E+03	-17.04
12600.	15.42	147.00	4.87	0.6482E+03	0.8115E+03	-17.13
12700.	16.40	141.00	4.78	0.6458E+03	0.8087E+03	-17.22
12800.	17.39	146.00	4.69	0.6434E+03	0.8060E+03	-17.31
12900.	13.78	144.00	4.60	0.6410E+03	0.8032E+03	-17.40
13000.	14.44	149.00	4.51	0.6386E+03	0.8005E+03	-17.49
13100.	13.45	159.00	4.37	0.6362E+03	0.7979E+03	-17.60
13200.	11.15	147.00	4.23	0.6338E+03	0.7953E+03	-17.71
13300.	13.12	150.00	4.09	0.6315E+03	0.7927E+03	-17.82
13400.	12.47	148.00	3.95	0.6291E+03	0.7902E+03	-17.93
13500.	12.47	136.00	3.81	0.6267E+03	0.7876E+03	-18.04
13600.	12.47	151.00	3.67	0.6244E+03	0.7851E+03	-18.15
13700.	16.73	156.00	3.53	0.6221E+03	0.7825E+03	-18.26
13800.	14.11	161.00	3.39	0.6197E+03	0.7800E+03	-18.37
13900.	14.76	166.00	3.25	0.6174E+03	0.7775E+03	-18.48
14000.	14.11	163.00	3.11	0.6151E+03	0.7750E+03	-18.59
14100.	11.48	163.00	3.07	0.6128E+03	0.7722E+03	-18.64
14200.	10.83	166.00	3.03	0.6105E+03	0.7694E+03	-18.69
14300.	7.55	174.00	2.99	0.6082E+03	0.7667E+03	-18.74
14400.	8.20	182.00	2.95	0.6060E+03	0.7639E+03	-18.79
14500.	6.23	177.00	2.91	0.6037E+03	0.7612E+03	-18.84
14600.	8.53	172.00	2.87	0.6014E+03	0.7584E+03	-18.89
14700.	6.23	165.00	2.83	0.5992E+03	0.7557E+03	-18.94
14800.	4.59	180.00	2.79	0.5970E+03	0.7530E+03	-18.99
14900.	3.61	161.00	2.75	0.5947E+03	0.7503E+03	-19.04

Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
15000.	2.95	262.00	2.71	0.5925E+03	0.7476E+03	-19.09
15100.	4.92	208.00	2.53	0.5903E+03	0.7453E+03	-19.22
15200.	4.92	222.00	2.35	0.5880E+03	0.7429E+03	-19.35
15300.	8.53	206.00	2.17	0.5858E+03	0.7406E+03	-19.48
15400.	7.22	195.00	1.99	0.5836E+03	0.7383E+03	-19.61
15500.	9.51	185.00	1.81	0.5814E+03	0.7360E+03	-19.74
15600.	7.87	171.00	1.63	0.5792E+03	0.7337E+03	-19.87
15700.	6.89	181.00	1.45	0.5770E+03	0.7314E+03	-20.00
15800.	5.58	166.00	1.27	0.5748E+03	0.7291E+03	-20.13
15900.	1.97	199.00	1.09	0.5727E+03	0.7269E+03	-20.26
16000.	3.61	198.00	0.91	0.5705E+03	0.7246E+03	-20.39
16100.	0.98	342.00	0.66	0.5683E+03	0.7225E+03	-20.50
16200.	2.62	311.00	0.41	0.5662E+03	0.7205E+03	-20.61
16300.	1.97	348.00	0.16	0.5641E+03	0.7184E+03	-20.72
16400.	4.59	332.00	-0.09	0.5619E+03	0.7163E+03	-20.83
16500.	3.28	349.00	-0.34	0.5598E+03	0.7143E+03	-20.94
16600.	5.25	325.00	-0.59	0.5577E+03	0.7122E+03	-21.05
16700.	4.27	296.00	-0.84	0.5556E+03	0.7102E+03	-21.16
16800.	4.92	300.00	-1.09	0.5535E+03	0.7082E+03	-21.27
16900.	5.58	285.00	-1.34	0.5514E+03	0.7062E+03	-21.38
17000.	3.94	291.00	-1.59	0.5493E+03	0.7041E+03	-21.49
17100.	7.22	283.00	-1.85	0.5472E+03	0.7021E+03	-21.70
17200.	5.58	274.00	-2.11	0.5451E+03	0.7001E+03	-21.91
17300.	6.89	274.00	-2.37	0.5430E+03	0.6981E+03	-22.12
17400.	6.56	244.00	-2.63	0.5409E+03	0.6961E+03	-22.33
17500.	7.55	269.00	-2.89	0.5389E+03	0.6941E+03	-22.54
17600.	6.89	254.00	-3.15	0.5368E+03	0.6921E+03	-22.75
17700.	7.22	277.00	-3.41	0.5347E+03	0.6901E+03	-22.96
17800.	8.20	257.00	-3.67	0.5327E+03	0.6882E+03	-23.17
17900.	6.56	255.00	-3.93	0.5306E+03	0.6862E+03	-23.38
18000.	5.58	264.00	-4.19	0.5286E+03	0.6842E+03	-23.59
18100.	6.23	231.00	-4.45	0.5266E+03	0.6822E+03	-23.83
18200.	6.23	260.00	-4.71	0.5245E+03	0.6803E+03	-24.07
18300.	7.87	266.00	-4.97	0.5225E+03	0.6783E+03	-24.31
18400.	3.94	277.00	-5.23	0.5205E+03	0.6763E+03	-24.55
18500.	6.56	305.00	-5.49	0.5185E+03	0.6744E+03	-24.79
18600.	6.23	290.00	-5.75	0.5164E+03	0.6724E+03	-25.03
18700.	5.58	312.00	-6.01	0.5144E+03	0.6705E+03	-25.27
18800.	8.53	304.00	-6.27	0.5125E+03	0.6686E+03	-25.51
18900.	7.87	283.00	-6.53	0.5105E+03	0.6666E+03	-25.75
19000.	7.87	288.00	-6.79	0.5085E+03	0.6647E+03	-25.99
19100.	9.19	280.00	-6.98	0.5065E+03	0.6626E+03	-26.17
19200.	8.20	266.00	-7.17	0.5045E+03	0.6605E+03	-26.35
19300.	8.53	288.00	-7.36	0.5025E+03	0.6584E+03	-26.53
19400.	7.87	260.00	-7.55	0.5006E+03	0.6563E+03	-26.71
19500.	6.56	264.00	-7.74	0.4987E+03	0.6542E+03	-26.89
19600.	7.22	258.00	-7.93	0.4967E+03	0.6521E+03	-27.07
19700.	9.19	261.00	-8.12	0.4948E+03	0.6500E+03	-27.25
19800.	11.15	284.00	-8.31	0.4928E+03	0.6480E+03	-27.43
19900.	12.80	272.00	-8.50	0.4909E+03	0.6459E+03	-27.61

Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
20000.	14.44	283.00	-8.69	0.4890E+03	0.6438E+03	-27.79
20100.	18.37	281.00	-8.90	0.4871E+03	0.6418E+03	-27.93
20200.	17.39	275.00	-9.11	0.4852E+03	0.6398E+03	-28.07
20300.	17.39	283.00	-9.32	0.4833E+03	0.6378E+03	-28.21
20400.	18.70	281.00	-9.53	0.4814E+03	0.6359E+03	-28.35
20500.	18.04	285.00	-9.74	0.4795E+03	0.6339E+03	-28.49
20600.	19.03	289.00	-9.95	0.4776E+03	0.6319E+03	-28.63
20700.	19.03	280.00	-10.16	0.4758E+03	0.6299E+03	-28.77
20800.	18.70	290.00	-10.37	0.4739E+03	0.6280E+03	-28.91
20900.	19.69	290.00	-10.58	0.4720E+03	0.6260E+03	-29.05
21000.	19.69	284.00	-10.79	0.4702E+03	0.6241E+03	-29.19
21100.	19.69	293.00	-11.04	0.4683E+03	0.6222E+03	-29.40
21200.	21.33	291.00	-11.29	0.4665E+03	0.6203E+03	-29.61
21300.	19.69	289.00	-11.54	0.4646E+03	0.6185E+03	-29.82
21400.	20.67	294.00	-11.79	0.4628E+03	0.6166E+03	-30.03
21500.	21.98	281.00	-12.04	0.4610E+03	0.6148E+03	-30.24
21600.	20.34	288.00	-12.29	0.4591E+03	0.6129E+03	-30.45
21700.	21.98	287.00	-12.54	0.4573E+03	0.6111E+03	-30.66
21800.	20.34	286.00	-12.79	0.4555E+03	0.6092E+03	-30.87
21900.	21.98	282.00	-13.04	0.4537E+03	0.6074E+03	-31.08
22000.	21.33	278.00	-13.29	0.4519E+03	0.6056E+03	-31.29
22100.	22.97	279.00	-13.53	0.4501E+03	0.6037E+03	-31.49
22200.	24.93	274.00	-13.77	0.4483E+03	0.6019E+03	-31.69
22300.	25.26	281.00	-14.01	0.4465E+03	0.6000E+03	-31.89
22400.	26.25	280.00	-14.25	0.4447E+03	0.5982E+03	-32.09
22500.	26.25	281.00	-14.49	0.4429E+03	0.5963E+03	-32.29
22600.	27.56	284.00	-14.73	0.4411E+03	0.5945E+03	-32.49
22700.	26.50	286.00	-14.97	0.4394E+03	0.5926E+03	-32.69
22800.	26.90	288.00	-15.21	0.4376E+03	0.5908E+03	-32.89
22900.	25.26	280.00	-15.45	0.4358E+03	0.5890E+03	-33.09
23000.	24.93	285.00	-15.69	0.4341E+03	0.5872E+03	-33.29
23100.	28.54	283.00	-15.95	0.4323E+03	0.5854E+03	-33.16
23200.	29.53	280.00	-16.21	0.4306E+03	0.5836E+03	-33.03
23300.	33.79	277.00	-16.47	0.4289E+03	0.5819E+03	-32.90
23400.	32.81	274.00	-16.73	0.4271E+03	0.5801E+03	-32.77
23500.	33.46	276.00	-16.99	0.4254E+03	0.5783E+03	-32.64
23600.	33.79	275.00	-17.25	0.4237E+03	0.5766E+03	-32.51
23700.	33.79	277.00	-17.51	0.4220E+03	0.5748E+03	-32.38
23800.	32.48	275.00	-17.77	0.4203E+03	0.5731E+03	-32.25
23900.	33.46	277.00	-18.03	0.4186E+03	0.5714E+03	-32.12
24000.	32.15	276.00	-18.29	0.4169E+03	0.5696E+03	-31.99
24100.	33.79	276.00	-18.49	0.4152E+03	0.5678E+03	-32.26
24200.	33.79	276.00	-18.69	0.4135E+03	0.5659E+03	-32.53
24300.	30.84	275.00	-18.89	0.4118E+03	0.5640E+03	-32.80
24400.	35.76	271.00	-19.09	0.4101E+03	0.5622E+03	-33.07
24500.	33.14	270.00	-19.29	0.4085E+03	0.5603E+03	-33.34
24600.	35.43	270.00	-19.49	0.4068E+03	0.5585E+03	-33.61
24700.	35.76	268.00	-19.69	0.4051E+03	0.5567E+03	-33.88
24800.	37.73	268.00	-19.89	0.4035E+03	0.5548E+03	-34.15
24900.	39.70	263.00	-20.09	0.4018E+03	0.5530E+03	-34.42

Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
25000.	39.37	264.00	-20.29	0.4002E+03	0.5512E+03	-34.69
25100.	40.35	261.00	-20.49	0.3986E+03	0.5494E+03	-34.98
25200.	38.06	263.00	-20.69	0.3969E+03	0.5476E+03	-35.27
25300.	37.07	260.00	-20.89	0.3953E+03	0.5458E+03	-35.56
25400.	35.43	263.00	-21.09	0.3937E+03	0.5440E+03	-35.85
25500.	34.78	264.00	-21.29	0.3921E+03	0.5422E+03	-36.14
25600.	33.79	265.00	-21.49	0.3905E+03	0.5404E+03	-36.43
25700.	33.14	268.00	-21.69	0.3889E+03	0.5386E+03	-36.72
25800.	35.43	268.00	-21.89	0.3873E+03	0.5368E+03	-37.01
25900.	33.14	273.00	-22.09	0.3857E+03	0.5350E+03	-37.30
26000.	34.12	269.00	-22.29	0.3841E+03	0.5333E+03	-37.59
26100.	33.46	266.00	-22.55	0.3825E+03	0.5316E+03	-37.77
26200.	32.81	270.00	-22.81	0.3809E+03	0.5300E+03	-37.95
26300.	32.81	270.00	-23.07	0.3794E+03	0.5283E+03	-38.13
26400.	33.14	273.00	-23.33	0.3778E+03	0.5267E+03	-38.31
26500.	33.14	272.00	-23.59	0.3762E+03	0.5251E+03	-38.49
26600.	33.14	273.00	-23.85	0.3747E+03	0.5234E+03	-38.67
26700.	33.14	273.00	-24.11	0.3731E+03	0.5218E+03	-38.85
26800.	35.43	275.00	-24.37	0.3716E+03	0.5202E+03	-39.03
26900.	35.76	277.00	-24.63	0.3700E+03	0.5186E+03	-39.21
27000.	34.78	274.00	-24.89	0.3685E+03	0.5170E+03	-39.39
27100.	36.42	278.00	-25.12	0.3670E+03	0.5153E+03	-39.58
27200.	36.09	276.00	-25.35	0.3654E+03	0.5136E+03	-39.77
27300.	36.09	277.00	-25.58	0.3639E+03	0.5119E+03	-39.96
27400.	37.40	276.00	-25.81	0.3623E+03	0.5102E+03	-40.15
27500.	35.76	277.00	-26.04	0.3608E+03	0.5086E+03	-40.34
27600.	38.39	277.00	-26.27	0.3593E+03	0.5069E+03	-40.53
27700.	37.40	278.00	-26.50	0.3578E+03	0.5053E+03	-40.72
27800.	38.39	278.00	-26.73	0.3563E+03	0.5036E+03	-40.91
27900.	36.75	275.00	-26.96	0.3548E+03	0.5020E+03	-41.10
28000.	37.73	277.00	-27.19	0.3533E+03	0.5003E+03	-41.29
28100.	40.03	276.00	-27.44	0.3518E+03	0.4987E+03	-41.46
28200.	41.67	275.00	-27.69	0.3503E+03	0.4971E+03	-41.63
28300.	44.62	278.00	-27.94	0.3489E+03	0.4955E+03	-41.80
28400.	44.29	275.00	-28.19	0.3474E+03	0.4940E+03	-41.97
28500.	43.31	277.00	-28.44	0.3459E+03	0.4924E+03	-42.14
28600.	43.64	273.00	-28.69	0.3445E+03	0.4908E+03	-42.31
28700.	42.98	273.00	-28.94	0.3430E+03	0.4892E+03	-42.48
28800.	42.98	274.00	-29.19	0.3416E+03	0.4877E+03	-42.65
28900.	41.34	276.00	-29.44	0.3401E+03	0.4861E+03	-42.82
29000.	41.99	278.00	-29.69	0.3387E+03	0.4846E+03	-42.99
29100.	41.99	277.00	-29.92	0.3373E+03	0.4830E+03	-43.16
29200.	40.35	282.00	-30.15	0.3358E+03	0.4814E+03	-43.33
29300.	42.65	287.00	-30.38	0.3344E+03	0.4798E+03	-43.50
29400.	43.64	285.00	-30.61	0.3329E+03	0.4782E+03	-43.67
29500.	45.60	290.00	-30.84	0.3315E+03	0.4766E+03	-43.84
29600.	47.24	291.00	-31.07	0.3301E+03	0.4750E+03	-44.01
29700.	49.54	292.00	-31.30	0.3287E+03	0.4734E+03	-44.18
29800.	51.18	292.00	-31.53	0.3273E+03	0.4718E+03	-44.35
29900.	53.81	294.00	-31.76	0.3259E+03	0.4703E+03	-44.52

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Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
30000.	52.49	291.00	-31.99	0.3245E+03	0.4687E+03	-44.69
30100.	53.81	293.00	-32.21	0.3231E+03	0.4671E+03	-44.90
30200.	55.77	293.00	-32.43	0.3217E+03	0.4655E+03	-45.11
30300.	56.43	295.00	-32.65	0.3203E+03	0.4639E+03	-45.32
30400.	59.38	295.00	-32.87	0.3189E+03	0.4624E+03	-45.53
30500.	59.38	293.00	-33.09	0.3176E+03	0.4608E+03	-45.74
30600.	58.40	293.00	-33.31	0.3162E+03	0.4592E+03	-45.95
30700.	61.02	292.00	-33.53	0.3148E+03	0.4577E+03	-46.16
30800.	59.71	291.00	-33.75	0.3135E+03	0.4561E+03	-46.37
30900.	60.04	293.00	-33.97	0.3121E+03	0.4546E+03	-46.58
31000.	61.35	292.00	-34.19	0.3108E+03	0.4531E+03	-46.79
31100.	61.35	293.00	-34.44	0.3095E+03	0.4516E+03	-46.99
31200.	64.96	292.00	-34.69	0.3081E+03	0.4501E+03	-47.19
31300.	65.62	288.00	-34.94	0.3068E+03	0.4486E+03	-47.39
31400.	65.94	290.00	-35.19	0.3055E+03	0.4471E+03	-47.59
31500.	64.63	288.00	-35.44	0.3041E+03	0.4457E+03	-47.79
31600.	64.96	291.00	-35.69	0.3028E+03	0.4442E+03	-47.99
31700.	66.60	288.00	-35.94	0.3015E+03	0.4427E+03	-48.19
31800.	64.96	290.00	-36.19	0.3002E+03	0.4413E+03	-48.39
31900.	66.27	291.00	-36.44	0.2989E+03	0.4398E+03	-48.59
32000.	68.57	292.00	-36.69	0.2976E+03	0.4384E+03	-48.79
32100.	68.24	293.00	-36.93	0.2963E+03	0.4369E+03	-49.05
32200.	70.21	294.00	-37.17	0.2950E+03	0.4354E+03	-49.31
32300.	71.52	294.00	-37.41	0.2937E+03	0.4339E+03	-49.57
32400.	72.83	293.00	-37.65	0.2924E+03	0.4325E+03	-49.83
32500.	74.80	295.00	-37.89	0.2911E+03	0.4310E+03	-50.09
32600.	74.48	295.00	-38.13	0.2898E+03	0.4295E+03	-50.35
32700.	75.13	297.00	-38.37	0.2885E+03	0.4281E+03	-50.61
32800.	75.46	296.00	-38.61	0.2872E+03	0.4266E+03	-50.87
32900.	75.46	296.00	-38.85	0.2860E+03	0.4252E+03	-51.13
33000.	76.77	295.00	-39.09	0.2847E+03	0.4237E+03	-51.39
33100.	74.80	297.00	-39.35	0.2834E+03	0.4223E+03	-51.60
33200.	75.13	296.00	-39.61	0.2822E+03	0.4209E+03	-51.81
33300.	73.49	296.00	-39.87	0.2809E+03	0.4195E+03	-52.02
33400.	74.80	297.00	-40.13	0.2797E+03	0.4181E+03	-52.23
33500.	75.46	295.00	-40.39	0.2784E+03	0.4167E+03	-52.44
33600.	75.13	296.00	-40.65	0.2772E+03	0.4153E+03	-52.65
33700.	76.77	292.00	-40.91	0.2760E+03	0.4139E+03	-52.86
33800.	76.44	289.00	-41.17	0.2747E+03	0.4126E+03	-53.07
33900.	77.10	291.00	-41.43	0.2735E+03	0.4112E+03	-53.28
34000.	75.79	289.00	-41.69	0.2723E+03	0.4098E+03	-53.49
34100.	75.46	288.00	-41.84	0.2699E+03	0.4067E+03	-53.62
34200.	78.08	289.00	-41.99	0.2687E+03	0.4051E+03	-53.88
34300.	77.10	286.00	-42.14	0.2675E+03	0.4036E+03	-54.01
34400.	76.77	285.00	-42.29	0.2663E+03	0.4021E+03	-54.14
34500.	75.79	284.00	-42.44	0.2651E+03	0.4005E+03	-54.27
34600.	77.10	283.00	-42.59	0.2638E+03	0.3990E+03	-54.40
34700.	79.07	281.00	-42.74	0.2627E+03	0.3975E+03	-54.53
34800.	79.72	282.00	-42.89	0.2616E+03	0.3960E+03	-54.66
34900.	81.04	283.00	-43.04			

Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
35000.	84.32	281.00	-43.19	0.2604E+03	0.3945E+03	-54.79
35100.	88.91	280.00	-43.27	0.2592E+03	0.3928E+03	-54.85
35200.	89.89	280.00	-43.35	0.2581E+03	0.3912E+03	-54.91
35300.	91.21	278.00	-43.43	0.2569E+03	0.3896E+03	-54.97
35400.	90.88	280.00	-43.51	0.2557E+03	0.3879E+03	-55.03
35500.	94.82	281.00	-43.59	0.2546E+03	0.3863E+03	-55.09
35600.	97.11	279.00	-43.67	0.2534E+03	0.3847E+03	-55.15
35700.	98.43	279.00	-43.75	0.2523E+03	0.3831E+03	-55.21
35800.	102.69	278.00	-43.83	0.2512E+03	0.3815E+03	-55.27
35900.	104.00	277.00	-43.91	0.2500E+03	0.3799E+03	-55.33
36000.	109.58	277.00	-43.99	0.2489E+03	0.3784E+03	-55.39
36100.	110.89	276.00	-44.17	0.2478E+03	0.3769E+03	-55.54
36200.	112.86	276.00	-44.35	0.2467E+03	0.3755E+03	-55.69
36300.	115.49	277.00	-44.53	0.2455E+03	0.3741E+03	-55.84
36400.	117.45	276.00	-44.71	0.2444E+03	0.3728E+03	-55.99
36500.	119.75	277.00	-44.89	0.2433E+03	0.3714E+03	-56.14
36600.	119.42	277.00	-45.07	0.2422E+03	0.3700E+03	-56.29
36700.	118.77	277.00	-45.25	0.2411E+03	0.3686E+03	-56.44
36800.	121.39	277.00	-45.43	0.2401E+03	0.3672E+03	-56.59
36900.	120.08	278.00	-45.61	0.2390E+03	0.3659E+03	-56.74
37000.	122.38	278.00	-45.79	0.2379E+03	0.3645E+03	-56.89
37100.	122.05	276.00	-46.05	0.2368E+03	0.3632E+03	-57.11
37200.	121.72	278.00	-46.31	0.2357E+03	0.3620E+03	-57.33
37300.	121.06	278.00	-46.57	0.2346E+03	0.3607E+03	-57.55
37400.	121.72	277.00	-46.83	0.2336E+03	0.3595E+03	-57.77
37500.	120.08	278.00	-47.09	0.2325E+03	0.3583E+03	-57.99
37600.	121.72	276.00	-47.35	0.2314E+03	0.3570E+03	-58.21
37700.	120.08	277.00	-47.61	0.2304E+03	0.3558E+03	-58.43
37800.	121.06	278.00	-47.87	0.2293E+03	0.3546E+03	-58.65
37900.	121.39	279.00	-48.13	0.2282E+03	0.3534E+03	-58.87
38000.	122.38	278.00	-48.39	0.2272E+03	0.3521E+03	-59.09
38100.	121.06	280.00	-48.65	0.2261E+03	0.3509E+03	-59.30
38200.	125.66	276.00	-48.91	0.2251E+03	0.3497E+03	-59.51
38300.	122.05	279.00	-49.17	0.2241E+03	0.3485E+03	-59.72
38400.	125.66	280.00	-49.43	0.2230E+03	0.3473E+03	-59.93
38500.	122.05	279.00	-49.69	0.2220E+03	0.3461E+03	-60.14
38600.	122.05	281.00	-49.95	0.2210E+03	0.3449E+03	-60.35
38700.	123.36	280.00	-50.21	0.2199E+03	0.3437E+03	-60.56
38800.	123.36	280.00	-50.47	0.2189E+03	0.3425E+03	-60.77
38900.	124.34	282.00	-50.73	0.2179E+03	0.3413E+03	-60.98
39000.	126.97	280.00	-50.99	0.2169E+03	0.3401E+03	-61.19
39100.	124.67	281.00	-51.17	0.2159E+03	0.3388E+03	-61.34
39200.	127.30	281.00	-51.35	0.2149E+03	0.3375E+03	-61.49
39300.	124.34	282.00	-51.53	0.2139E+03	0.3362E+03	-61.64
39400.	129.92	284.00	-51.71	0.2129E+03	0.3349E+03	-61.79
39500.	128.61	282.00	-51.89	0.2119E+03	0.3336E+03	-61.94
39600.	127.62	280.00	-52.07	0.2109E+03	0.3323E+03	-62.09
39700.	129.92	283.00	-52.25	0.2099E+03	0.3310E+03	-62.24
39800.	128.61	281.00	-52.43	0.2089E+03	0.3298E+03	-62.39
39900.	129.92	280.00	-52.61	0.2080E+03	0.3285E+03	-62.54

Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
40000.	130.91	282.00	-52.79	0.2070E+03	0.3272E+03	-52.69
40100.	131.89	280.00	-53.00	0.2060E+03	0.3260E+03	-62.88
40200.	131.89	283.00	-53.21	0.2051E+03	0.3248E+03	-63.07
40300.	132.22	279.00	-53.42	0.2041E+03	0.3236E+03	-63.26
40400.	134.51	278.00	-53.63	0.2031E+03	0.3224E+03	-63.45
40500.	136.81	278.00	-53.84	0.2022E+03	0.3212E+03	-63.64
40600.	139.76	279.00	-54.05	0.2012E+03	0.3200E+03	-63.83
40700.	138.78	280.00	-54.26	0.2003E+03	0.3188E+03	-64.02
40800.	138.78	278.00	-54.47	0.1994E+03	0.3176E+03	-64.21
40900.	140.75	279.00	-54.68	0.1984E+03	0.3164E+03	-64.40
41000.	141.40	277.00	-54.89	0.1975E+03	0.3152E+03	-64.59
41100.	141.40	279.00	-55.13	0.1966E+03	0.3141E+03	-64.80
41200.	144.68	275.00	-55.37	0.1956E+03	0.3129E+03	-65.01
41300.	142.72	277.00	-55.61	0.1947E+03	0.3118E+03	-65.22
41400.	142.72	277.00	-55.85	0.1938E+03	0.3106E+03	-65.43
41500.	147.64	273.00	-56.09	0.1928E+03	0.3095E+03	-65.64
41600.	144.03	277.00	-56.33	0.1919E+03	0.3084E+03	-65.85
41700.	146.33	275.00	-56.57	0.1910E+03	0.3072E+03	-66.06
41800.	141.08	278.00	-56.81	0.1901E+03	0.3061E+03	-66.27
41900.	143.37	276.00	-57.05	0.1892E+03	0.3050E+03	-66.48
42000.	142.72	278.00	-57.29	0.1883E+03	0.3039E+03	-66.69
42100.	143.04	278.00	-57.56	0.1874E+03	0.3028E+03	-9999.00
42200.	143.37	277.00	-57.83	0.1865E+03	0.3017E+03	-9999.00
42300.	143.70	279.00	-58.10	0.1856E+03	0.3006E+03	-9999.00
42400.	143.37	278.00	-58.37	0.1847E+03	0.2996E+03	-9999.00
42500.	142.06	279.00	-58.64	0.1838E+03	0.2985E+03	-9999.00
42600.	143.37	278.00	-58.91	0.1829E+03	0.2974E+03	-9999.00
42700.	143.37	279.00	-59.18	0.1820E+03	0.2964E+03	-9999.00
42800.	145.34	279.00	-59.45	0.1811E+03	0.2953E+03	-9999.00
42900.	144.68	279.00	-59.72	0.1803E+03	0.2942E+03	-9999.00
43000.	144.03	279.00	-59.99	0.1794E+03	0.2932E+03	-9999.00
43100.	142.39	281.00	-60.20	0.1785E+03	0.2921E+03	-9999.00
43200.	142.06	280.00	-60.41	0.1777E+03	0.2909E+03	-9999.00
43300.	144.36	280.00	-60.62	0.1768E+03	0.2898E+03	-9999.00
43400.	144.68	281.00	-60.83	0.1760E+03	0.2887E+03	-9999.00
43500.	145.01	281.00	-61.04	0.1751E+03	0.2876E+03	-9999.00
43600.	145.01	282.00	-61.25	0.1743E+03	0.2865E+03	-9999.00
43700.	145.34	282.00	-61.46	0.1734E+03	0.2854E+03	-9999.00
43800.	145.01	282.00	-61.67	0.1726E+03	0.2843E+03	-9999.00
43900.	146.33	284.00	-61.88	0.1717E+03	0.2832E+03	-9999.00
44000.	147.31	282.00	-62.09	0.1709E+03	0.2821E+03	-9999.00
44100.	145.34	282.00	-62.30	0.1701E+03	0.2810E+03	-9999.00
44200.	144.03	281.00	-62.51	0.1692E+03	0.2798E+03	-9999.00
44300.	142.39	282.00	-62.72	0.1684E+03	0.2787E+03	-9999.00
44400.	141.73	281.00	-62.93	0.1675E+03	0.2776E+03	-9999.00
44500.	139.76	281.00	-63.14	0.1667E+03	0.2765E+03	-9999.00
44600.	140.09	280.00	-63.35	0.1659E+03	0.2754E+03	-9999.00
44700.	139.11	281.00	-63.56	0.1650E+03	0.2743E+03	-9999.00
44800.	135.50	281.00	-63.77	0.1642E+03	0.2732E+03	-9999.00
44900.	133.53	281.00	-63.98	0.1634E+03	0.2722E+03	-9999.00

Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
45000.	131.23	281.00	-64.19	0.1626E+03	0.2711E+03	-9999.00
45100.	126.97	282.00	-64.41	0.1618E+03	0.2700E+03	-9999.00
45200.	127.95	281.00	-64.63	0.1610E+03	0.2690E+03	-9999.00
45300.	124.02	284.00	-64.85	0.1602E+03	0.2679E+03	-9999.00
45400.	123.36	282.00	-65.07	0.1594E+03	0.2669E+03	-9999.00
45500.	121.06	282.00	-65.29	0.1586E+03	0.2658E+03	-9999.00
45600.	117.78	283.00	-65.51	0.1578E+03	0.2648E+03	-9999.00
45700.	114.83	285.00	-65.73	0.1570E+03	0.2637E+03	-9999.00
45800.	113.19	283.00	-65.95	0.1562E+03	0.2627E+03	-9999.00
45900.	112.20	283.00	-66.17	0.1555E+03	0.2617E+03	-9999.00
46000.	110.24	282.00	-66.39	0.1547E+03	0.2607E+03	-9999.00
46100.	107.28	283.00	-66.60	0.1539E+03	0.2596E+03	-9999.00
46200.	105.97	282.00	-66.81	0.1532E+03	0.2586E+03	-9999.00
46300.	104.33	282.00	-67.02	0.1524E+03	0.2576E+03	-9999.00
46400.	103.67	283.00	-67.23	0.1517E+03	0.2566E+03	-9999.00
46500.	101.05	282.00	-67.44	0.1509E+03	0.2556E+03	-9999.00
46600.	101.05	280.00	-67.65	0.1502E+03	0.2545E+03	-9999.00
46700.	97.44	282.00	-67.86	0.1494E+03	0.2535E+03	-9999.00
46800.	96.13	282.00	-68.07	0.1487E+03	0.2525E+03	-9999.00
46900.	95.80	280.00	-68.28	0.1479E+03	0.2516E+03	-9999.00
47000.	95.80	282.00	-68.49	0.1472E+03	0.2506E+03	-9999.00
47100.	95.14	280.00	-68.62	0.1465E+03	0.2494E+03	-9999.00
47200.	93.18	280.00	-68.75	0.1457E+03	0.2483E+03	-9999.00
47300.	90.88	278.00	-68.88	0.1450E+03	0.2472E+03	-9999.00
47400.	89.24	276.00	-69.01	0.1442E+03	0.2461E+03	-9999.00
47500.	86.94	277.00	-69.14	0.1435E+03	0.2450E+03	-9999.00
47600.	87.27	276.00	-69.27	0.1428E+03	0.2440E+03	-9999.00
47700.	88.91	275.00	-69.40	0.1421E+03	0.2429E+03	-9999.00
47800.	88.91	277.00	-69.53	0.1413E+03	0.2418E+03	-9999.00
47900.	88.91	277.00	-69.66	0.1406E+03	0.2407E+03	-9999.00
48000.	86.61	278.00	-69.79	0.1399E+03	0.2397E+03	-9999.00
48100.	83.99	276.00	-69.77	0.1392E+03	0.2384E+03	-9999.00
48200.	82.02	277.00	-69.76	0.1385E+03	0.2372E+03	-9999.00
48300.	82.02	277.00	-69.75	0.1378E+03	0.2360E+03	-9999.00
48400.	81.69	278.00	-69.74	0.1371E+03	0.2347E+03	-9999.00
48500.	81.69	279.00	-69.73	0.1364E+03	0.2335E+03	-9999.00
48600.	81.04	281.00	-69.72	0.1357E+03	0.2323E+03	-9999.00
48700.	79.40	283.00	-69.71	0.1350E+03	0.2311E+03	-9999.00
48800.	80.71	277.00	-69.70	0.1343E+03	0.2299E+03	-9999.00
48900.	76.77	281.00	-69.70	0.1336E+03	0.2287E+03	-9999.00
49000.	74.15	282.00	-69.69	0.1329E+03	0.2276E+03	-9999.00
49100.	72.51	282.00	-69.81	0.1322E+03	0.2265E+03	-9999.00
49200.	71.85	277.00	-69.93	0.1316E+03	0.2255E+03	-9999.00
49300.	69.55	281.00	-70.05	0.1309E+03	0.2245E+03	-9999.00
49400.	69.88	278.00	-70.17	0.1302E+03	0.2235E+03	-9999.00
49500.	70.54	277.00	-70.29	0.1296E+03	0.2225E+03	-9999.00
49600.	71.52	276.00	-70.41	0.1289E+03	0.2215E+03	-9999.00
49700.	71.85	277.00	-70.53	0.1282E+03	0.2205E+03	-9999.00
49800.	73.16	275.00	-70.65	0.1276E+03	0.2195E+03	-9999.00
49900.	74.48	278.00	-70.77	0.1269E+03	0.2185E+03	-9999.00

Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
50000.	75.79	282.00	-70.89	0.1263E+03	0.2175E+03	-9999.00
50100.	77.76	282.00	-70.87	0.1257E+03	0.2164E+03	-9999.00
50200.	78.08	284.00	-70.85	0.1250E+03	0.2153E+03	-9999.00
50300.	76.77	286.00	-70.83	0.1244E+03	0.2142E+03	-9999.00
50400.	78.41	290.00	-70.81	0.1237E+03	0.2130E+03	-9999.00
50500.	75.79	288.00	-70.79	0.1231E+03	0.2119E+03	-9999.00
50600.	73.16	296.00	-70.77	0.1225E+03	0.2108E+03	-9999.00
50700.	71.85	292.00	-70.75	0.1219E+03	0.2097E+03	-9999.00
50800.	67.59	293.00	-70.73	0.1212E+03	0.2086E+03	-9999.00
50900.	64.30	291.00	-70.71	0.1206E+03	0.2076E+03	-9999.00
51000.	64.63	290.00	-70.69	0.1200E+03	0.2065E+03	-9999.00
51100.	65.29	290.00	-70.80	0.1194E+03	0.2055E+03	-9999.00
51200.	64.96	289.00	-70.91	0.1188E+03	0.2046E+03	-9999.00
51300.	64.63	290.00	-71.02	0.1182E+03	0.2037E+03	-9999.00
51400.	63.32	289.00	-71.13	0.1176E+03	0.2027E+03	-9999.00
51500.	64.30	286.00	-71.24	0.1170E+03	0.2018E+03	-9999.00
51600.	62.66	286.00	-71.35	0.1164E+03	0.2009E+03	-9999.00
51700.	61.68	284.00	-71.46	0.1158E+03	0.2000E+03	-9999.00
51800.	60.70	279.00	-71.57	0.1152E+03	0.1990E+03	-9999.00
51900.	61.02	281.00	-71.68	0.1146E+03	0.1981E+03	-9999.00
52000.	56.10	285.00	-71.79	0.1140E+03	0.1972E+03	-9999.00
52100.	56.10	280.00	-71.86	0.1134E+03	0.1963E+03	-9999.00
52200.	55.77	275.00	-71.93	0.1128E+03	0.1954E+03	-9999.00
52300.	51.84	278.00	-72.00	0.1123E+03	0.1944E+03	-9999.00
52400.	50.20	273.00	-72.07	0.1117E+03	0.1935E+03	-9999.00
52500.	54.13	270.00	-72.14	0.1111E+03	0.1926E+03	-9999.00
52600.	55.45	277.00	-72.21	0.1105E+03	0.1917E+03	-9999.00
52700.	57.74	272.00	-72.28	0.1100E+03	0.1907E+03	-9999.00
52800.	58.07	274.00	-72.35	0.1094E+03	0.1898E+03	-9999.00
52900.	59.38	273.00	-72.42	0.1089E+03	0.1889E+03	-9999.00
53000.	63.32	271.00	-72.49	0.1083E+03	0.1880E+03	-9999.00
53100.	61.68	273.00	-72.62	0.1077E+03	0.1872E+03	-9999.00
53200.	61.02	271.00	-72.75	0.1072E+03	0.1863E+03	-9999.00
53300.	61.68	274.00	-72.88	0.1067E+03	0.1855E+03	-9999.00
53400.	62.99	271.00	-73.01	0.1061E+03	0.1847E+03	-9999.00
53500.	61.35	276.00	-73.14	0.1056E+03	0.1839E+03	-9999.00
53600.	57.74	279.00	-73.27	0.1050E+03	0.1830E+03	-9999.00
53700.	59.38	271.00	-73.40	0.1045E+03	0.1822E+03	-9999.00
53800.	59.06	274.00	-73.53	0.1040E+03	0.1814E+03	-9999.00
53900.	56.43	273.00	-73.66	0.1034E+03	0.1806E+03	-9999.00
54000.	53.48	275.00	-73.79	0.1029E+03	0.1798E+03	-9999.00
54100.	53.15	275.00	-73.86	0.1024E+03	0.1789E+03	-9999.00
54200.	48.23	280.00	-73.93	0.1018E+03	0.1781E+03	-9999.00
54300.	47.24	281.00	-74.00	0.1013E+03	0.1772E+03	-9999.00
54400.	50.20	277.00	-74.07	0.1008E+03	0.1763E+03	-9999.00
54500.	52.17	278.00	-74.14	0.1003E+03	0.1755E+03	-9999.00
54600.	55.77	278.00	-74.21	0.9973E+02	0.1746E+03	-9999.00
54700.	55.45	281.00	-74.28	0.9921E+02	0.1738E+03	-9999.00
54800.	56.43	281.00	-74.35	0.9869E+02	0.1729E+03	-9999.00
54900.	53.81	286.00	-74.42	0.9818E+02	0.1721E+03	-9999.00

Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
55000.	51.18	285.00	-74.49	0.9767E+02	0.1713E+03	-9999.00
55100.	48.56	290.00	-74.60	0.9716E+02	0.1705E+03	-9999.00
55200.	46.26	290.00	-74.71	0.9666E+02	0.1697E+03	-9999.00
55300.	45.93	289.00	-74.82	0.9615E+02	0.1689E+03	-9999.00
55400.	47.24	291.00	-74.93	0.9565E+02	0.1681E+03	-9999.00
55500.	46.59	291.00	-75.04	0.9515E+02	0.1673E+03	-9999.00
55600.	45.28	291.00	-75.15	0.9466E+02	0.1665E+03	-9999.00
55700.	43.64	295.00	-75.26	0.9416E+02	0.1658E+03	-9999.00
55800.	42.32	293.00	-75.37	0.9367E+02	0.1650E+03	-9999.00
55900.	42.65	295.00	-75.48	0.9319E+02	0.1642E+03	-9999.00
56000.	38.71	289.00	-75.59	0.9270E+02	0.1635E+03	-9999.00
56500.	38.06	292.00	-74.59	0.9031E+02	0.1584E+03	-9999.00
57000.	34.12	297.00	-74.09	0.8800E+02	0.1540E+03	-9999.00
57500.	29.86	303.00	-73.89	0.8574E+02	0.1499E+03	-9999.00
58000.	26.90	307.00	-74.19	0.8355E+02	0.1463E+03	-9999.00
58500.	25.26	304.00	-73.29	0.8141E+02	0.1419E+03	-9999.00
59000.	23.95	303.00	-72.69	0.7933E+02	0.1379E+03	-9999.00
59500.	23.29	309.00	-72.89	0.7731E+02	0.1345E+03	-9999.00
60000.	22.64	319.00	-72.79	0.7535E+02	0.1310E+03	-9999.00
60500.	21.98	333.00	-72.39	0.7343E+02	0.1274E+03	-9999.00
61000.	21.98	346.00	-71.59	0.7157E+02	0.1237E+03	-9999.00
61500.	20.01	350.00	-72.19	0.6975E+02	0.1209E+03	-9999.00
62000.	19.03	347.00	-72.09	0.6798E+02	0.1178E+03	-9999.00
62500.	19.69	345.00	-70.89	0.6626E+02	0.1141E+03	-9999.00
63000.	22.31	345.00	-70.19	0.6460E+02	0.1109E+03	-9999.00
63500.	24.28	346.00	-70.39	0.6297E+02	0.1082E+03	-9999.00
64000.	23.62	345.00	-70.19	0.6139E+02	0.1054E+03	-9999.00
64500.	22.64	341.00	-69.79	0.5985E+02	0.1025E+03	-9999.00
65000.	21.98	338.00	-68.89	0.5835E+02	0.9952E+02	-9999.00
65500.	21.65	338.00	-67.79	0.5690E+02	0.9652E+02	-9999.00
66000.	23.29	343.00	-66.79	0.5549E+02	0.9368E+02	-9999.00
66500.	25.92	348.00	-66.99	0.5412E+02	0.9145E+02	-9999.00
67000.	29.86	354.00	-66.99	0.5278E+02	0.8919E+02	-9999.00
67500.	33.46	359.00	-66.89	0.5147E+02	0.8693E+02	-9999.00
68000.	36.42	4.00	-66.19	0.5020E+02	0.8450E+02	-9999.00
68500.	37.40	8.00	-65.49	0.4897E+02	0.8215E+02	-9999.00
69000.	36.42	11.00	-64.49	0.4777E+02	0.7975E+02	-9999.00
69500.	34.78	13.00	-63.29	0.4661E+02	0.7737E+02	-9999.00
70000.	33.46	12.00	-62.49	0.4548E+02	0.7521E+02	-9999.00
70500.	32.81	9.00	-62.69	0.4437E+02	0.7344E+02	-9999.00
71000.	33.14	6.00	-62.79	0.4330E+02	0.7171E+02	-9999.00
71500.	34.12	2.00	-62.19	0.4225E+02	0.6977E+02	-9999.00
72000.	36.42	360.00	-61.09	0.4123E+02	0.6773E+02	-9999.00
72500.	37.73	1.00	-59.99	0.4024E+02	0.6576E+02	-9999.00
73000.	37.07	4.00	-60.19	0.3928E+02	0.6426E+02	-9999.00
73500.	34.12	12.00	-59.59	0.3834E+02	0.6254E+02	-9999.00
74000.	29.53	22.00	-59.59	0.3743E+02	0.6106E+02	-9999.00
74500.	24.28	36.00	-59.79	0.3653E+02	0.5965E+02	-9999.00
75000.	20.67	52.00	-59.59	0.3566E+02	0.5817E+02	-9999.00
75500.	18.70	66.00	-59.19	0.3481E+02	0.5668E+02	-9999.00

Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
76000.	17.06	74.00	-59.19	0.3398E+02	0.5533E+02	-9999.00
76500.	15.09	76.00	-59.09	0.3317E+02	0.5398E+02	-9999.00
77000.	13.12	75.00	-58.69	0.3238E+02	0.5260E+02	-9999.00
77500.	10.83	72.00	-57.99	0.3161E+02	0.5118E+02	-9999.00
78000.	7.55	64.00	-57.69	0.3087E+02	0.4991E+02	-9999.00
78500.	4.92	29.00	-57.19	0.3014E+02	0.4862E+02	-9999.00
79000.	6.56	339.00	-56.89	0.2913E+02	0.4741E+02	-9999.00
79500.	10.83	318.00	-55.49	0.2873E+02	0.4598E+02	-9999.00
80000.	16.08	312.00	-54.39	0.2806E+02	0.4468E+02	-9999.00
80500.	19.36	313.00	-53.29	0.2741E+02	0.4343E+02	-9999.00
81000.	20.34	317.00	-52.09	0.2678E+02	0.4220E+02	-9999.00
81500.	19.69	323.00	-51.29	0.2616E+02	0.4108E+02	-9999.00
82000.	18.37	327.00	-50.49	0.2556E+02	0.3999E+02	-9999.00
82500.	16.40	328.00	-49.59	0.2498E+02	0.3893E+02	-9999.00
83000.	13.45	325.00	-48.59	0.2441E+02	0.3787E+02	-9999.00
83500.	10.17	315.00	-47.89	0.2386E+02	0.3690E+02	-9999.00
84000.	7.55	304.00	-47.79	0.2332E+02	0.3605E+02	-9999.00
84500.	6.23	300.00	-47.69	0.2279E+02	0.3521E+02	-9999.00
85000.	6.23	306.00	-47.49	0.2227E+02	0.3438E+02	-9999.00
85500.	7.55	315.00	-47.39	0.2177E+02	0.3359E+02	-9999.00
86000.	9.51	317.00	-47.89	0.2128E+02	0.3291E+02	-9999.00
86500.	12.47	315.00	-47.59	0.2080E+02	0.3212E+02	-9999.00
87000.	15.09	314.00	-46.99	0.2033E+02	0.3132E+02	-9999.00
87500.	17.06	318.00	-46.29	0.1987E+02	0.3051E+02	-9999.00
88000.	19.03	325.00	-45.49	0.1943E+02	0.2973E+02	-9999.00
88500.	20.34	332.00	-44.49	0.1899E+02	0.2893E+02	-9999.00
89000.	20.01	339.00	-44.09	0.1857E+02	0.2759E+02	-9999.00
89500.	19.36	347.00	-43.89	0.1816E+02	0.2824E+02	-9999.00
90000.	19.03	353.00	-44.19	0.1775E+02	0.2701E+02	-9999.00
90500.	18.70	357.00	-44.39	0.1736E+02	0.2644E+02	-9999.00
91000.	18.70	358.00	-44.29	0.1697E+02	0.2583E+02	-9999.00
91500.	19.69	359.00	-44.29	0.1659E+02	0.2525E+02	-9999.00
92000.	20.34	358.00	-44.59	0.1623E+02	0.2474E+02	-9999.00
92500.	20.01	355.00	-43.89	0.1586E+02	0.2410E+02	-9999.00
93000.	20.01	351.00	-43.79	0.1551E+02	0.2356E+02	-9999.00
93500.	20.01	347.00	-44.09	0.1517E+02	0.2307E+02	-9999.00
94000.	21.00	341.00	-43.69	0.1483E+02	0.2251E+02	-9999.00
94500.	21.98	336.00	-43.19	0.1450E+02	0.2197E+02	-9999.00
95000.	22.31	332.00	-42.99	0.1418E+02	0.2146E+02	-9999.00
95500.	21.65	330.00	-42.89	0.1387E+02	0.2098E+02	-9999.00
96000.	20.34	330.00	-42.79	0.1356E+02	0.2051E+02	-9999.00
96500.	18.04	329.00	-41.99	0.1326E+02	0.1998E+02	-9999.00
97000.	16.40	330.00	-41.29	0.1297E+02	0.1949E+02	-9999.00
97500.	16.40	331.00	-41.09	0.1269E+02	0.1905E+02	-9999.00
98000.	17.39	333.00	-40.99	0.1241E+02	0.1862E+02	-9999.00
98500.	19.03	336.00	-40.79	0.1213E+02	0.1819E+02	-9999.00
99000.	20.67	340.00	-40.49	0.1187E+02	0.1777E+02	-9999.00
99500.	22.31	348.00	-40.39	0.1161E+02	0.1738E+02	-9999.00
100000.	24.61	356.00	-40.89	0.1136E+02	0.1704E+02	-9999.00
103000.	23.72	329.16	-39.42	0.9868E+01	0.1471E+02	-9999.00

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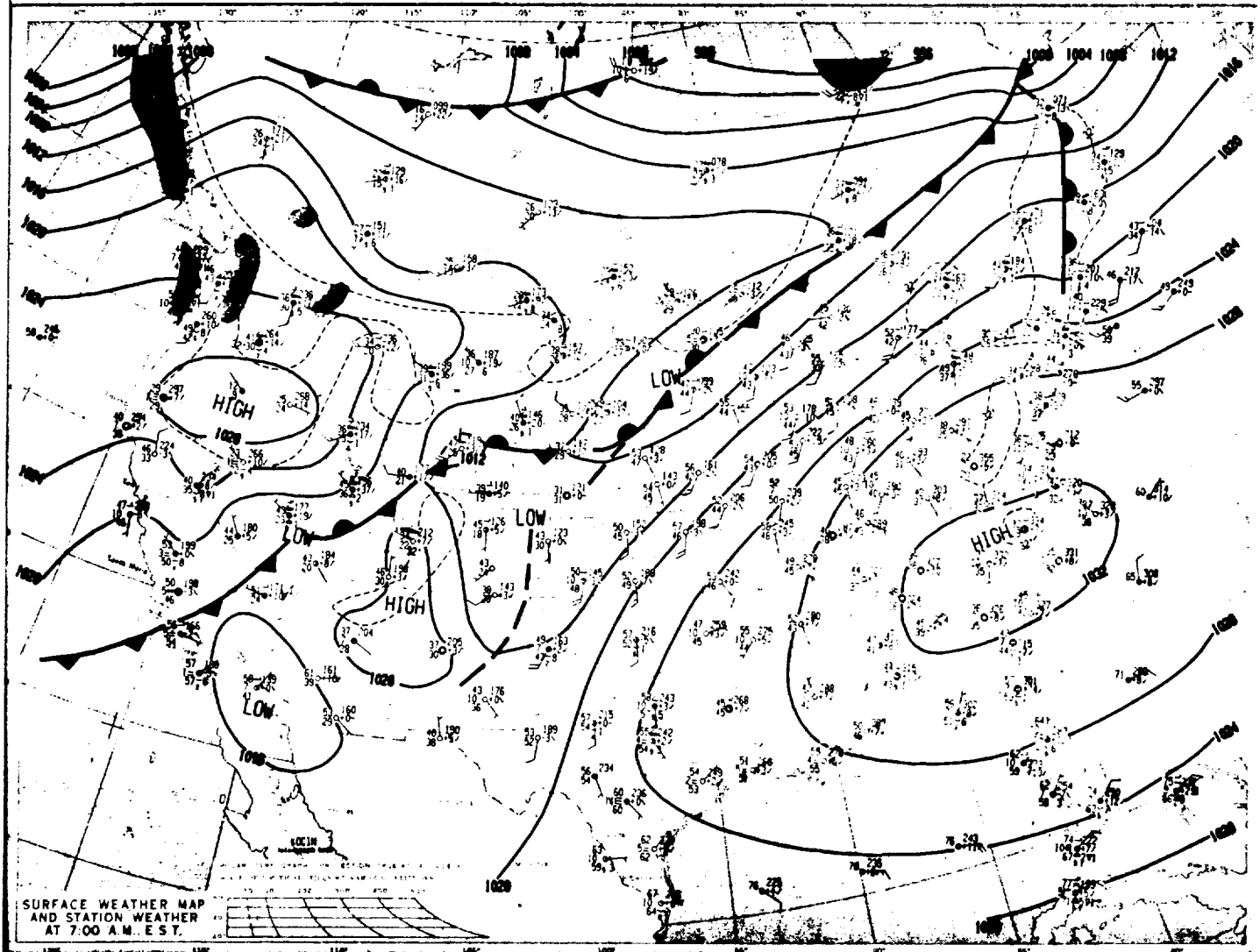
Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
106000.	27.80	305.60	-37.96	0.8573E+01	0.1270E+02	-9999.00
109000.	35.16	289.96	-36.49	0.7447E+01	0.1096E+02	-9999.00
112000.	44.19	280.19	-35.03	0.6469E+01	0.9465E+01	-9999.00
115000.	54.06	273.86	-33.56	0.5620E+01	0.8172E+01	-9999.00
118000.	61.15	274.12	-30.71	0.4960E+01	0.7127E+01	-9999.00
121000.	68.24	274.33	-27.85	0.4380E+01	0.6220E+01	-9999.00
124000.	75.33	274.50	-25.00	0.3870E+01	0.5433E+01	-9999.00
127000.	82.45	274.61	-22.14	0.3420E+01	0.4746E+01	-9999.00
130000.	89.54	274.73	-19.27	0.3020E+01	0.4144E+01	-9999.00
133000.	95.63	273.60	-16.73	0.2680E+01	0.3641E+01	-9999.00
136000.	101.06	271.75	-14.40	0.2380E+01	0.3204E+01	-9999.00
139000.	106.59	270.09	-12.08	0.2120E+01	0.2829E+01	-9999.00
142000.	112.21	268.59	-9.76	0.1890E+01	0.2500E+01	-9999.00
145000.	117.92	267.26	-7.44	0.1680E+01	0.2203E+01	-9999.00
148000.	123.77	266.17	-5.30	0.1500E+01	0.1951E+01	-9999.00
151000.	130.38	266.13	-4.45	0.1340E+01	0.1737E+01	-9999.00
154000.	137.03	266.11	-3.60	0.1200E+01	0.1551E+01	-9999.00
157000.	143.67	266.10	-2.75	0.1070E+01	0.1379E+01	-9999.00
160000.	150.29	266.08	-1.90	0.9570E+00	0.1229E+01	-9999.00
163000.	156.93	266.07	-1.05	0.8560E+00	0.1096E+01	-9999.00
166000.	160.83	265.64	-1.57	0.7650E+00	0.9813E+00	-9999.00
169000.	163.25	265.01	-2.81	0.6840E+00	0.8814E+00	-9999.00
172000.	165.72	264.39	-4.10	0.6110E+00	0.7911E+00	-9999.00
175000.	168.21	263.80	-5.45	0.5460E+00	0.7105E+00	-9999.00
178000.	170.68	263.22	-6.79	0.4870E+00	0.6369E+00	-9999.00
181000.	172.25	262.73	-8.42	0.4340E+00	0.5711E+00	-9999.00
184000.	169.66	262.58	-11.34	0.3860E+00	0.5136E+00	-9999.00
187000.	167.05	262.42	-14.25	0.3430E+00	0.4615E+00	-9999.00
190000.	164.47	262.24	-17.16	0.3040E+00	0.4137E+00	-9999.00
193000.	161.88	262.07	-20.07	0.2700E+00	0.3717E+00	-9999.00
196000.	159.27	261.89	-22.98	0.2400E+00	0.3342E+00	-9999.00
199000.	158.79	262.02	-25.92	0.2120E+00	0.2987E+00	-9999.00
202000.	159.12	262.27	-28.89	0.1860E+00	0.2653E+00	-9999.00
205000.	159.49	262.52	-31.85	0.1640E+00	0.2368E+00	-9999.00
208000.	159.83	262.77	-34.81	0.1440E+00	0.2105E+00	-9999.00
211000.	160.18	263.02	-37.78	0.1270E+00	0.1880E+00	-9999.00
214000.	157.80	263.33	-40.79	0.1120E+00	0.1679E+00	-9999.00
217000.	147.01	263.84	-43.91	0.9760E-01	0.1483E+00	-9999.00
220000.	136.24	264.43	-47.03	0.8530E-01	0.1314E+00	-9999.00
223000.	125.49	265.13	-50.16	0.7450E-01	0.1164E+00	-9999.00
226000.	114.79	265.95	-53.19	0.6510E-01	0.1031E+00	-9999.00
229000.	104.08	266.95	-56.23	0.5690E-01	0.9138E-01	-9999.00
232000.	96.58	265.56	-58.22	0.4930E-01	0.7991E-01	-9999.00
235000.	90.13	263.21	-59.92	0.4260E-01	0.6960E-01	-9999.00
238000.	83.83	260.49	-61.63	0.3690E-01	0.6077E-01	-9999.00
241000.	77.77	257.35	-63.34	0.3190E-01	0.5297E-01	-9999.00
244000.	71.97	253.66	-65.04	0.2760E-01	0.4620E-01	-9999.00
247000.	67.48	250.19	-66.56	0.2380E-01	0.4013E-01	-9999.00
250000.	65.33	248.12	-67.67	0.2050E-01	0.3476E-01	-9999.00
253000.	63.24	245.93	-68.91	0.1770E-01	0.3019E-01	-9999.00

Table 5. STS-38 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
256000.	61.26	243.57	-70.15	0.1520E-01	0.2608E-01	-9999.00
259000.	59.40	241.10	-71.39	0.1310E-01	0.2262E-01	-9999.00
262000.	57.65	238.43	-72.62	0.1130E-01	0.1963E-01	-9999.00
265000.	54.85	240.08	-73.29	0.9680E-02	0.1687E-01	-9999.00
268000.	51.99	242.77	-73.85	0.8310E-02	0.1453E-01	-9999.00
271000.	49.21	245.79	-74.41	0.7130E-02	0.1250E-01	-9999.00
274000.	46.61	249.18	-74.96	0.6120E-02	0.1076E-01	-9999.00
277000.	44.20	252.95	-75.53	0.5250E-02	0.9255E-02	-9999.00
280000.	38.58	256.18	-76.13	0.4500E-02	0.7957E-02	-9999.00
283000.	27.43	259.11	-76.72	0.3860E-02	0.6846E-02	-9999.00
286000.	16.45	265.88	-77.32	0.3310E-02	0.5888E-02	-9999.00
289000.	6.52	295.66	-77.92	0.2830E-02	0.5050E-02	-9999.00
292000.	8.26	34.32	-78.52	0.2430E-02	0.4349E-02	-9999.00
295000.	18.65	54.52	-79.12	0.2080E-02	0.3735E-02	-9999.00
298000.	27.03	270.28	-78.10	0.1780E-02	0.3179E-02	-9999.00
301000.	75.75	260.33	-76.92	0.1520E-02	0.2698E-02	-9999.00
304000.	120.99	257.77	-75.74	0.1300E-02	0.2294E-02	-9999.00
307000.	156.07	256.06	-74.55	0.1110E-02	0.1947E-02	-9999.00
310000.	171.97	254.05	-73.37	0.9480E-03	0.1653E-02	-9999.00
313000.	169.21	252.17	-71.76	0.8120E-03	0.1405E-02	-9999.00
316000.	168.84	251.63	-69.61	0.6980E-03	0.1195E-02	-9999.00
319000.	162.86	250.84	-67.46	0.6000E-03	0.1016E-02	-9999.00
322000.	149.39	249.60	-65.31	0.5160E-03	0.8649E-03	-9999.00
325000.	125.95	247.36	-63.16	0.4430E-03	0.7349E-03	-9999.00
328000.	89.77	242.18	-61.01	0.3810E-03	0.6257E-03	-9999.00
331000.	84.76	239.89	-57.54	0.3280E-03	0.5300E-03	-9999.00
334000.	76.68	236.77	-54.03	0.2830E-03	0.4499E-03	-9999.00
337000.	63.37	230.90	-50.52	0.2440E-03	0.3818E-03	-9999.00
340000.	44.61	216.72	-47.01	0.2110E-03	0.3250E-03	-9999.00
343000.	29.24	169.01	-43.50	0.1820E-03	0.2761E-03	-9999.00
346000.	37.22	132.46	-38.84	0.1580E-03	0.2349E-03	-9999.00
349000.	38.17	127.42	-33.05	0.1380E-03	0.2002E-03	-9999.00
352000.	38.81	120.71	-27.25	0.1210E-03	0.1714E-03	-9999.00
355000.	39.36	111.77	-21.46	0.1060E-03	0.1467E-03	-9999.00
358000.	40.47	99.94	-15.66	0.9260E-04	0.1253E-03	-9999.00
361000.	43.30	94.39	-9.76	0.8110E-04	0.1073E-03	-9999.00
364000.	44.88	90.17	-1.11	0.7300E-04	0.9348E-04	-9999.00
367000.	46.35	84.88	7.54	0.6560E-04	0.8142E-04	-9999.00
370000.	47.77	78.35	16.19	0.5900E-04	0.7104E-04	-9999.00
373000.	49.47	70.23	24.85	0.5290E-04	0.6184E-04	-9999.00
376000.	51.99	60.34	33.50	0.4750E-04	0.5396E-04	-9999.00
379000.	45.61	69.36	43.17	0.4300E-04	0.4736E-04	-9999.00
382000.	43.85	65.89	53.92	0.3940E-04	0.4197E-04	-9999.00
385000.	42.37	62.07	65.04	0.3620E-04	0.3729E-04	-9999.00
388000.	41.12	56.49	76.49	0.3340E-04	0.3328E-04	-9999.00
391000.	40.12	53.18	88.24	0.3090E-04	0.2979E-04	-9999.00
394000.	39.45	48.17	100.26	0.2870E-04	0.2678E-04	-9999.00
397000.	39.16	42.86	112.51	0.2670E-04	0.2412E-04	-9999.00
400000.	39.25	37.36	124.96	0.2490E-04	0.2179E-04	-9999.00

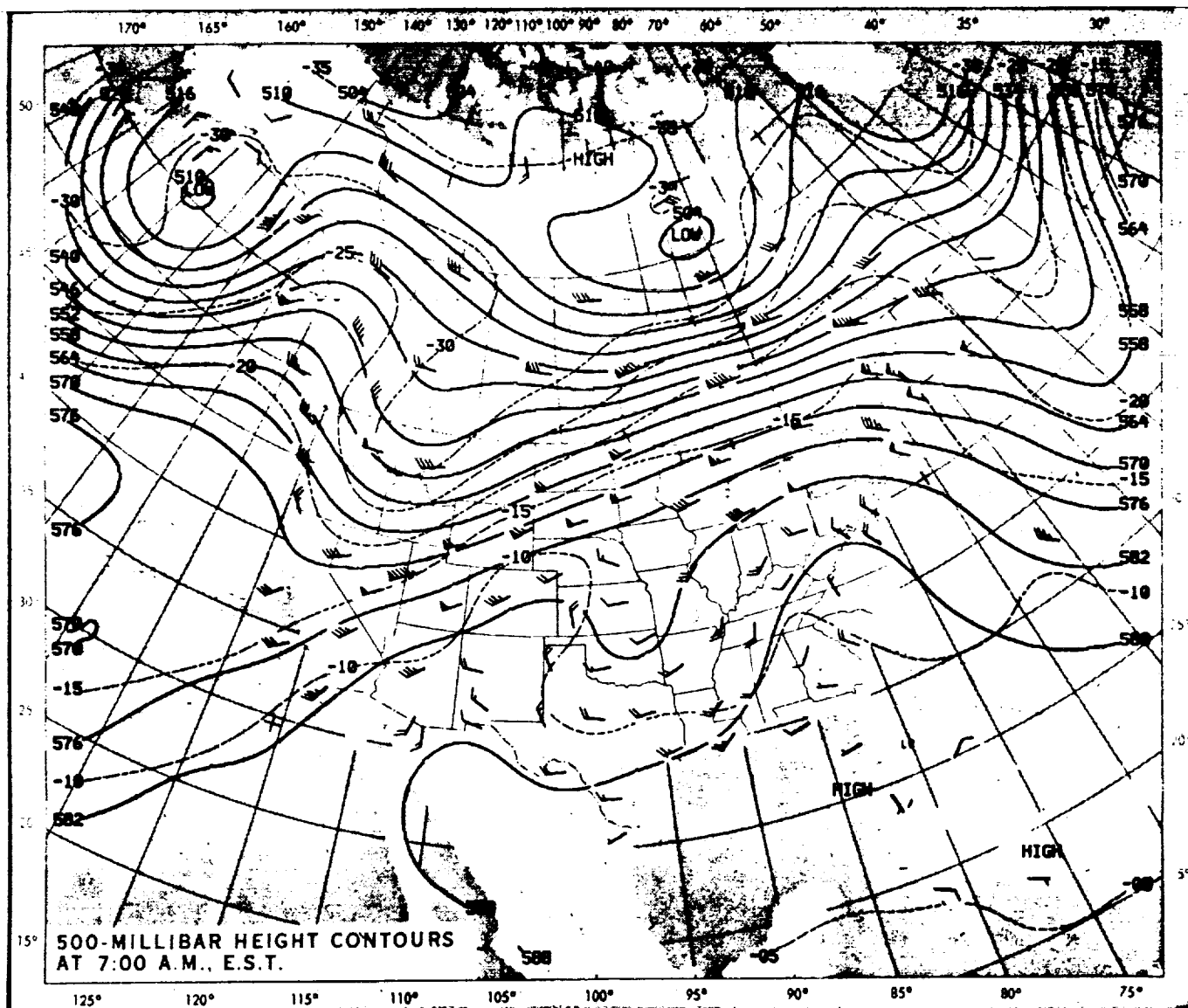
THURSDAY, NOVEMBER 15, 1990



Surface synoptic map at 1200 u.t. November 15, 1990—isobaric, frontal, and precipitation patterns are shown in standard symbolic form.

Figure 1. Surface synoptic chart 11 h 48 min before the launch of STS-38.

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500-mb height
 Contours at 1200 u.t.
 November 15, 1990
 Continuous lines indicate height contours at feet above sea level.
 Dashed lines are isotherms in degrees centigrade. Arrows show wind
 direction and speed at the 500-mb level.

Figure 2. 500-mb map 11 h 48 min before the launch of STS-38.

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Figure 3. GOES-7 infrared imagery of cloud cover 2 min before launch of STS-38 (2346 u.t., November 15, 1990. 500-mb heights (meters) and wind barbs are also included for 0000 u.t., November 16, 1990.

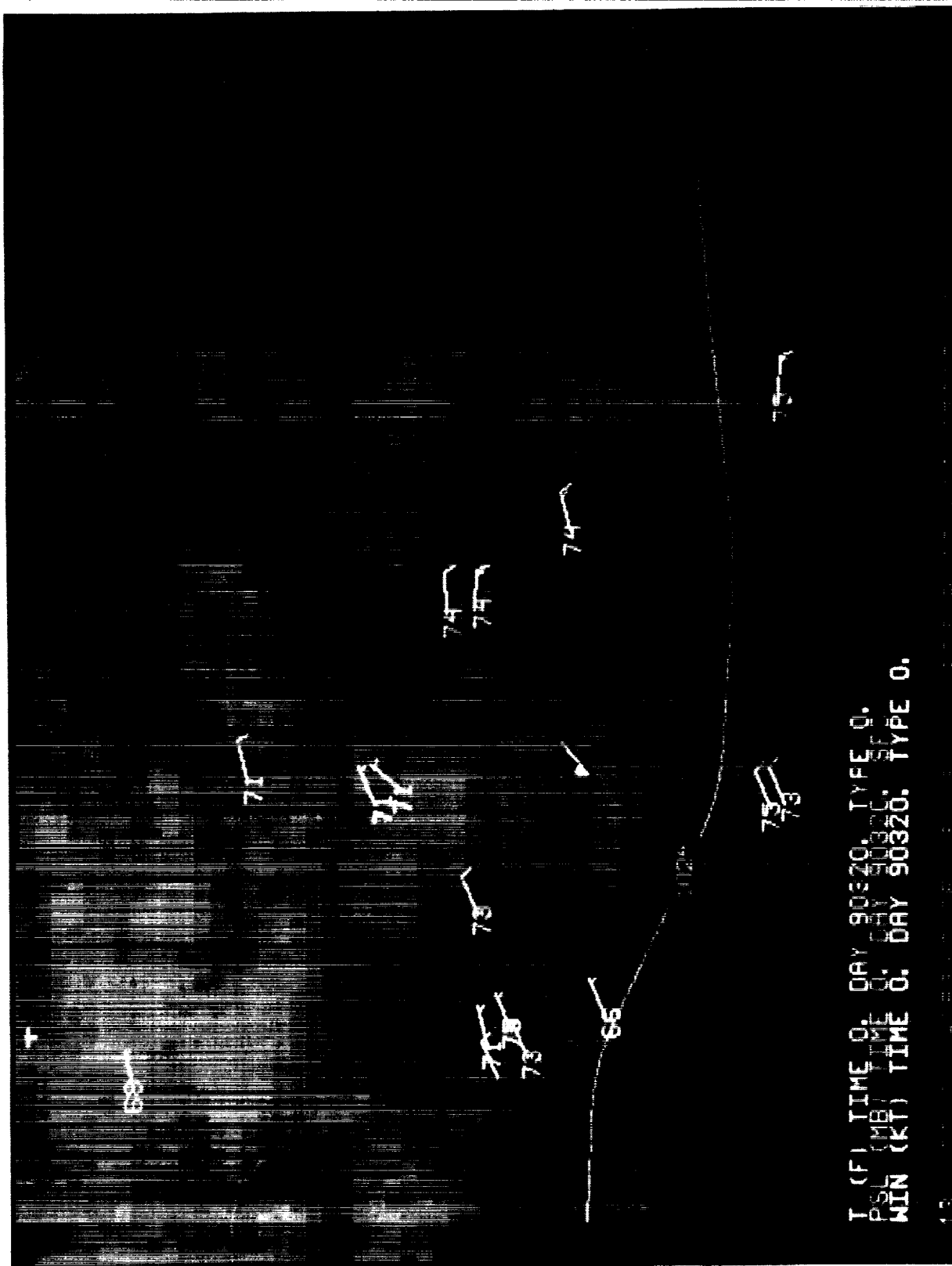


Figure 4. Enlarged view of GOES-7 infrared imagery of cloud cover taken 2 min before the launch of STS-38 (2346 u.t., November 15, 1990). Surface temperatures, isobaric parameters, and wind barbs for 0000 u.t., November 16, 1990, are also included.

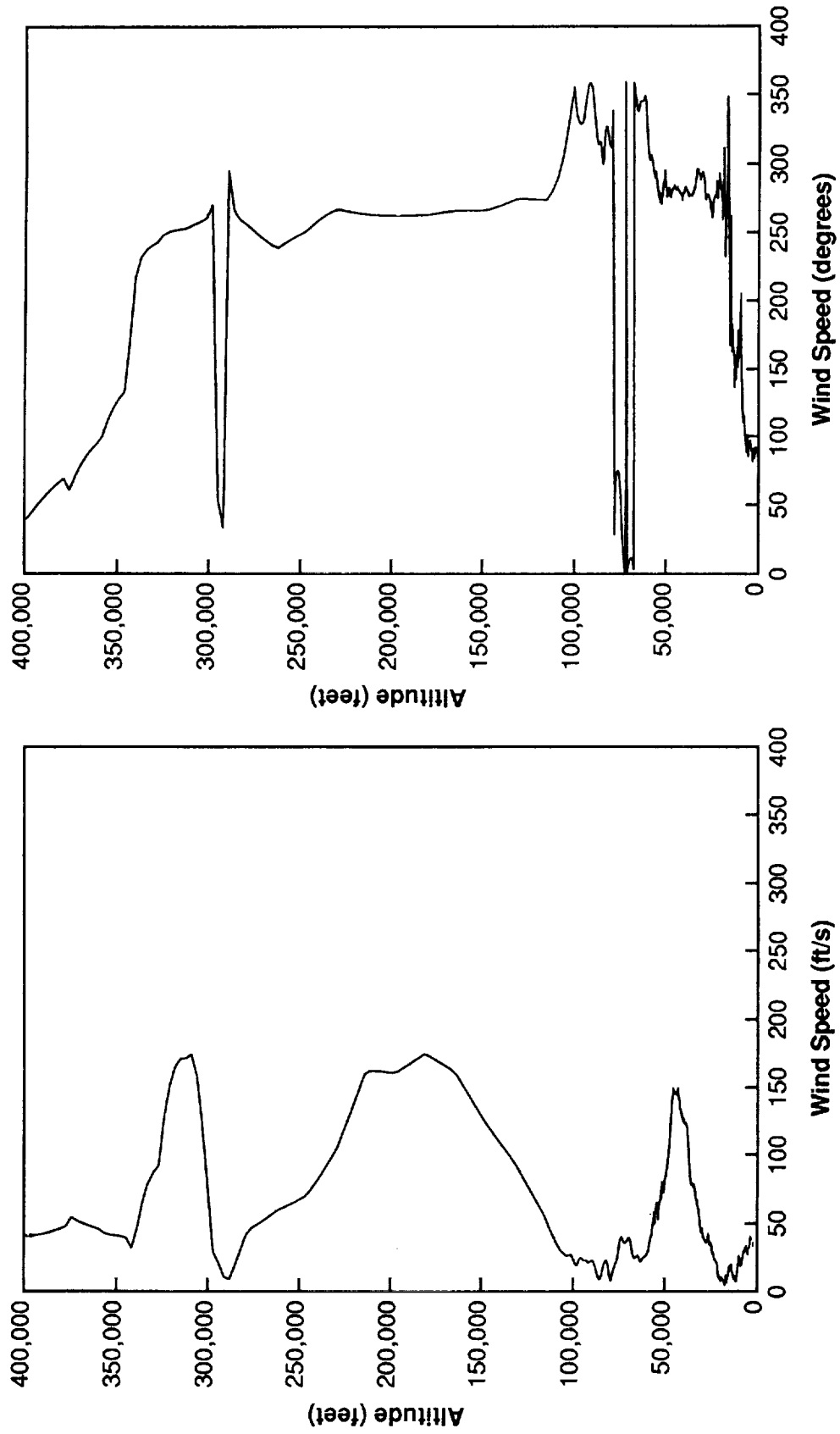


Figure 5. Scalar wind speed and direction at launch time of STS-38.

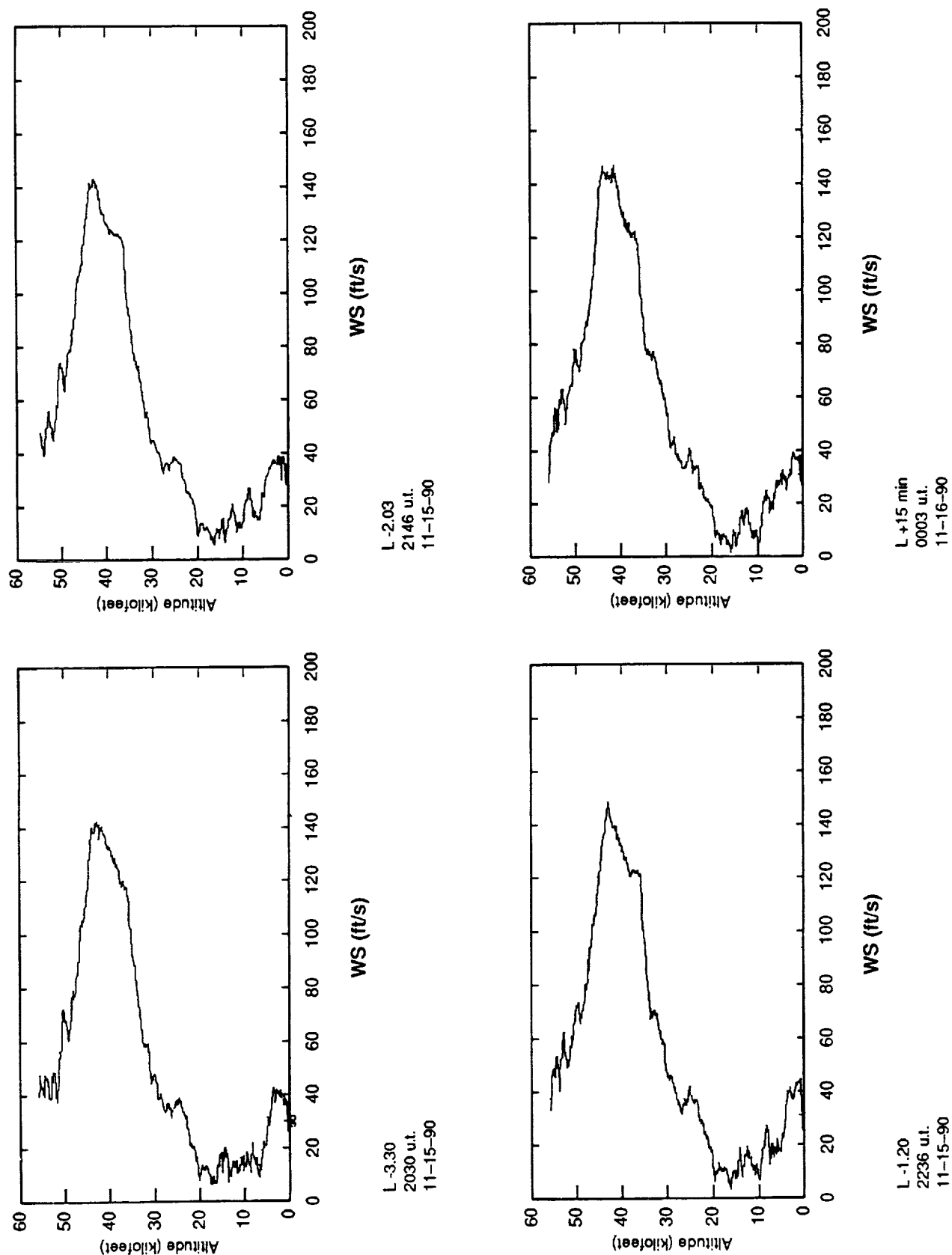


Figure 6. STS-38 prelaunch/launch Jimsphere-measured wind speeds (ft/s).

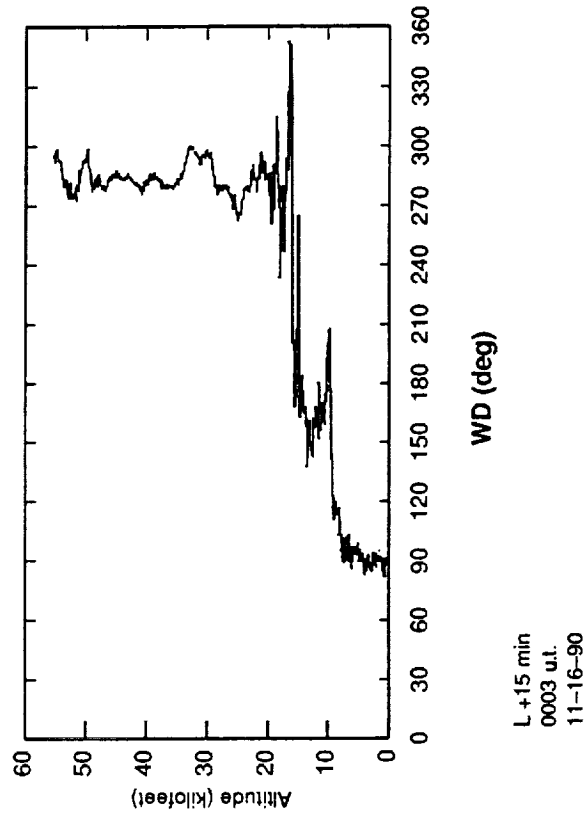
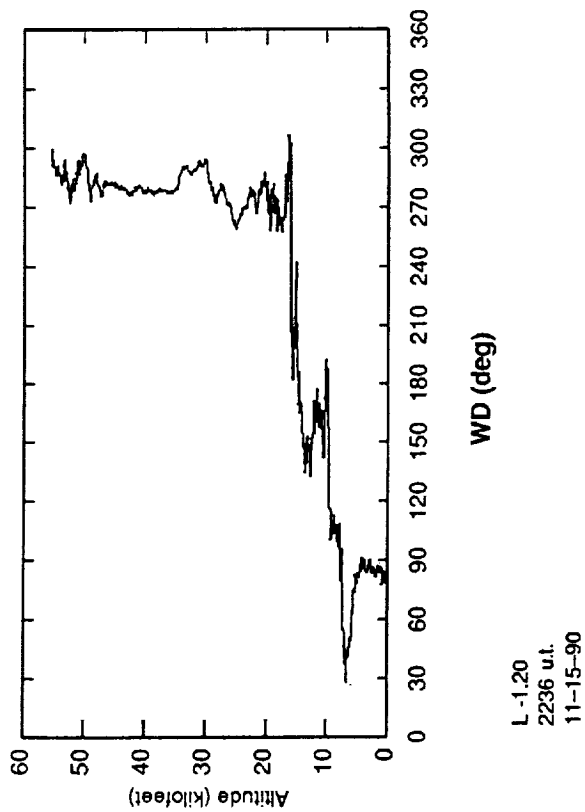
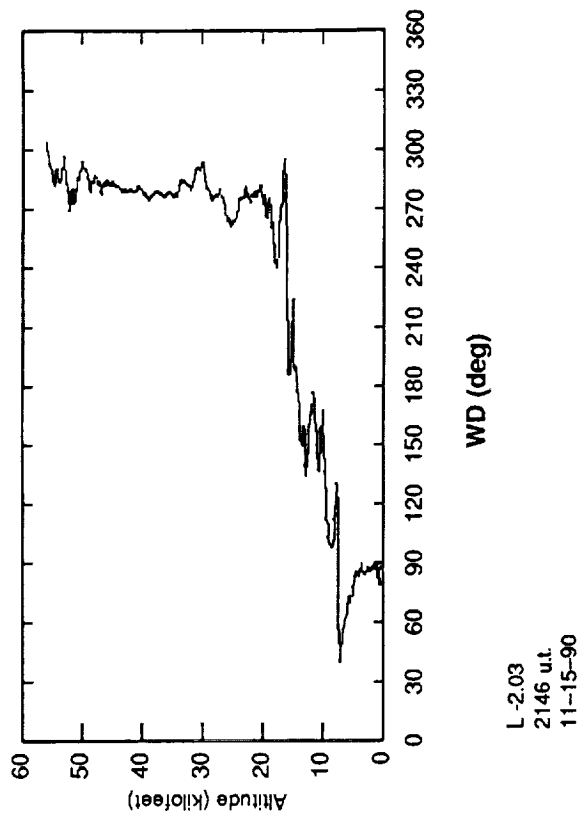
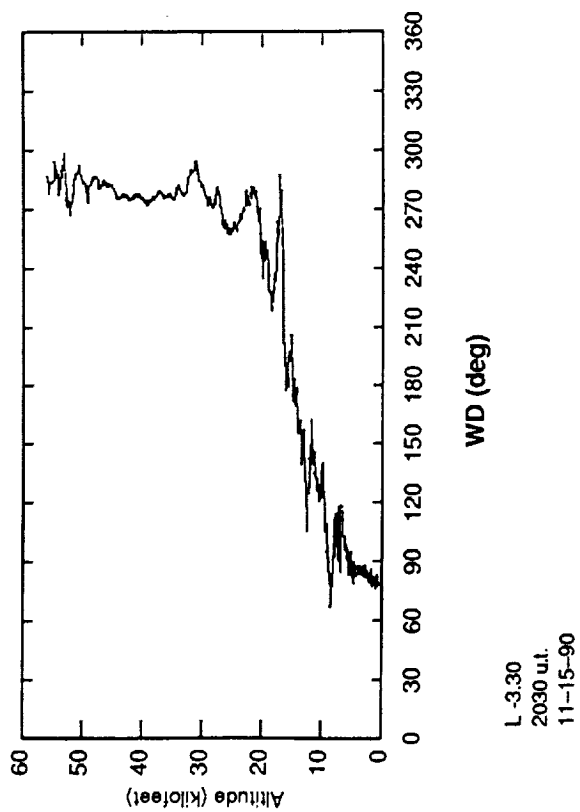


Figure 7. STS-38 prelaunch/launch Jimsphere-measured wind directions (degrees).

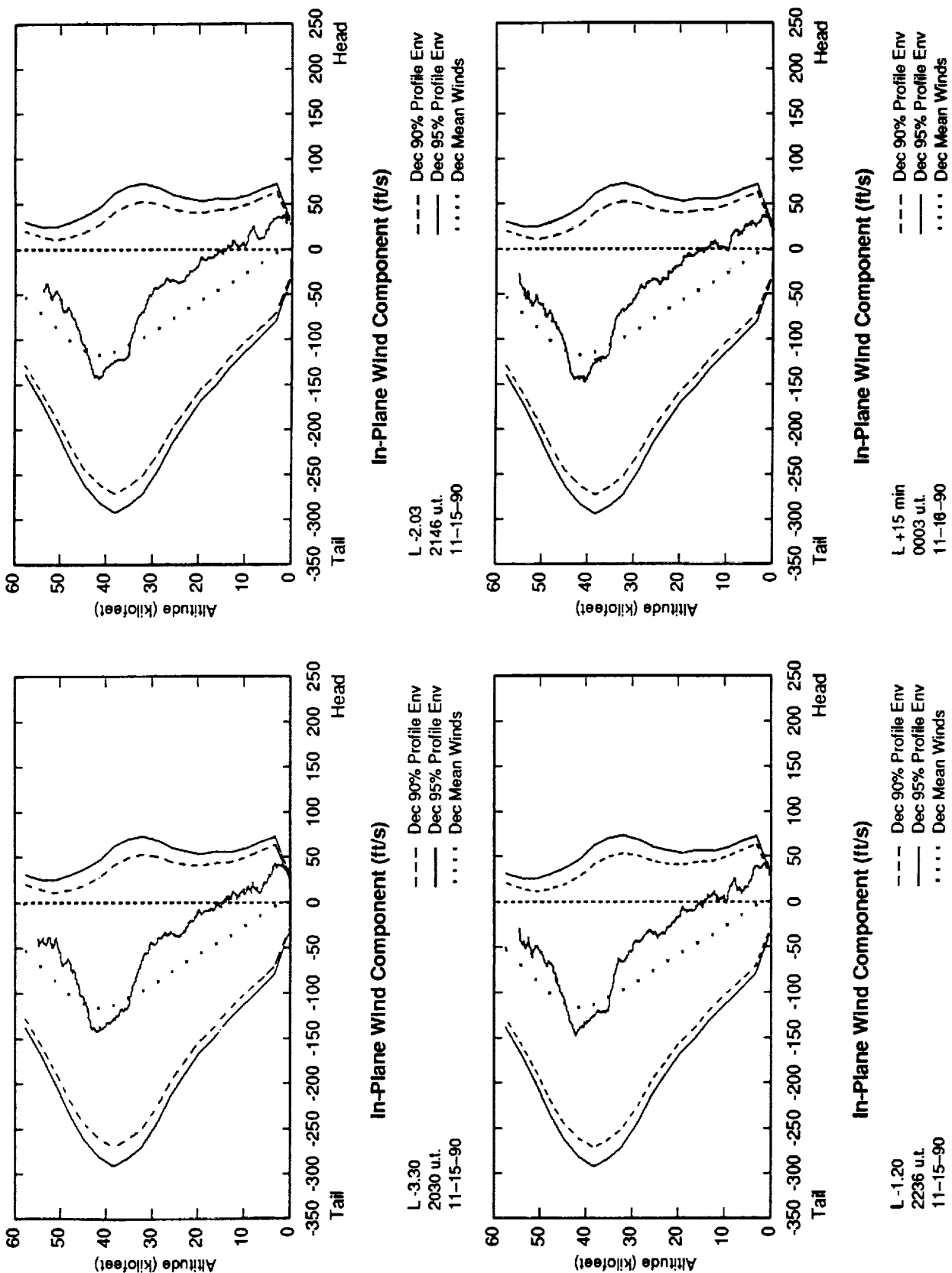


Figure 8. STS-38 prelaunch/launch Jimsphere-measured in-plane component winds (ft/s).
Reference flight azimuth = 90 degrees.

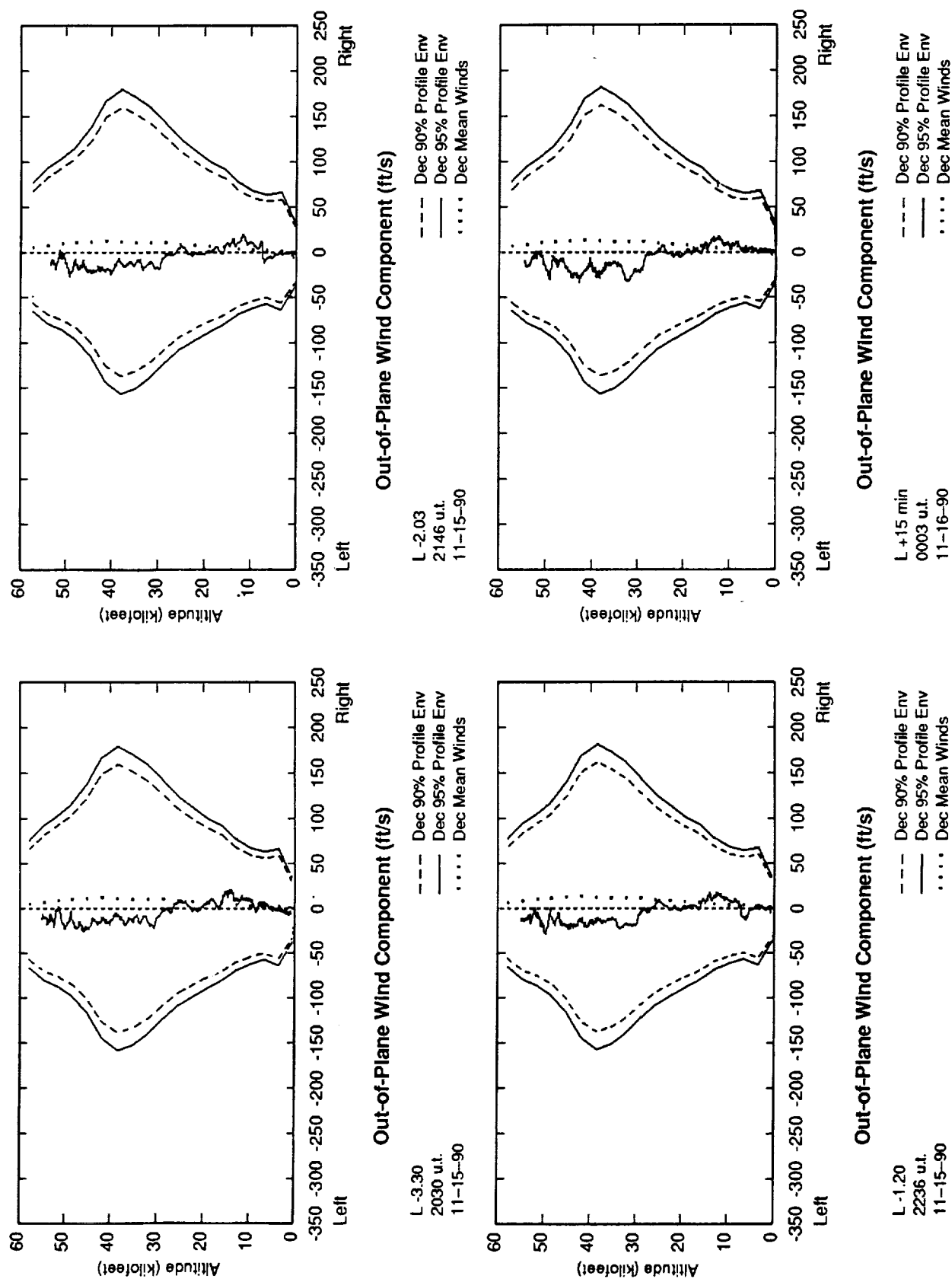


Figure 9. STS-38 prelaunch/launch Jimsphere-measured out-of-plane component winds (ft/s).
Reference flight azimuth = 90 degrees.

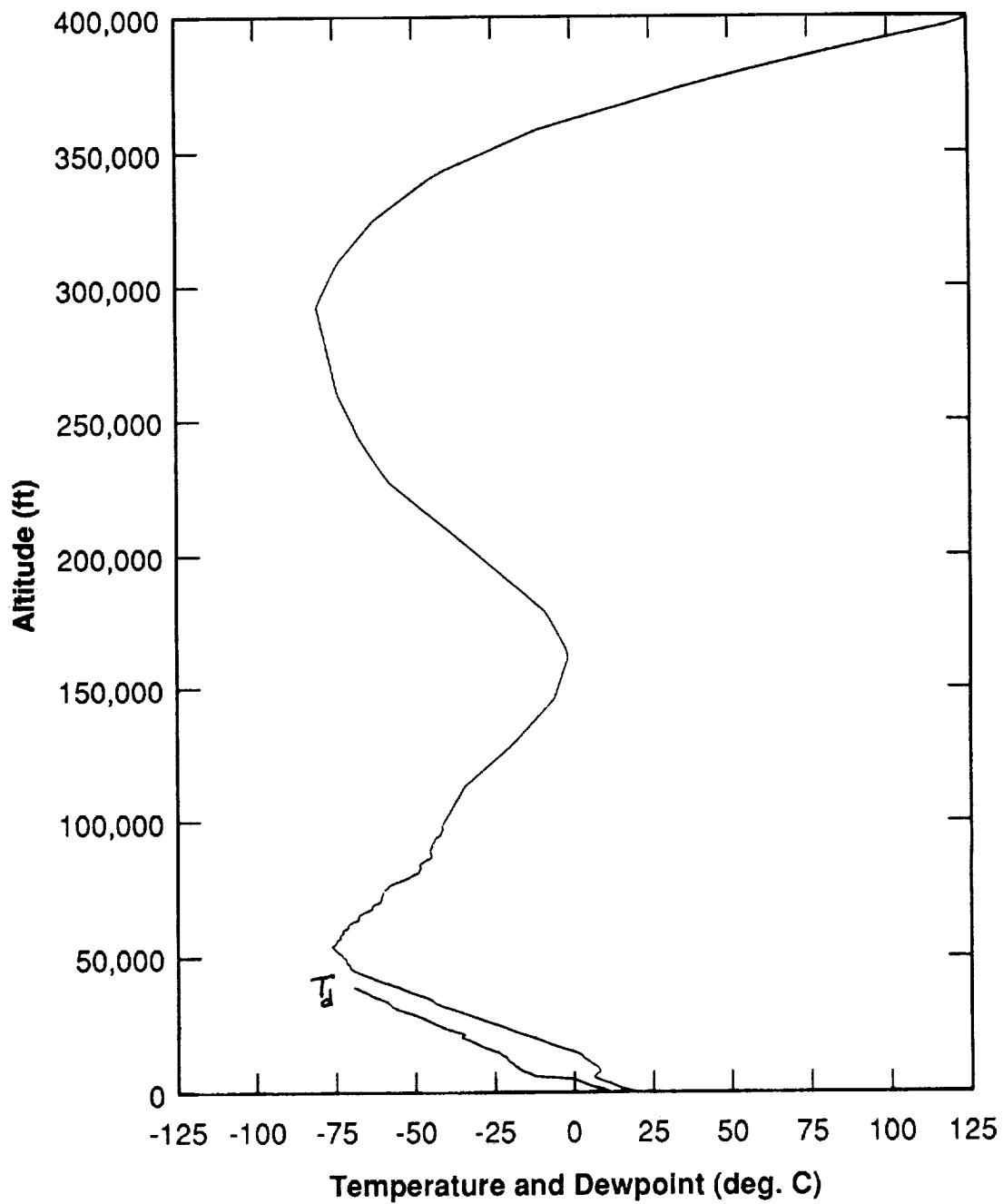


Figure 10. STS-38 temperature profiles versus altitude for launch (ascent).

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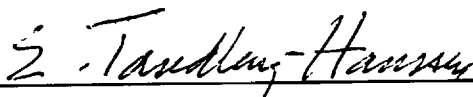
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APPROVAL

ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE (STS-38) LAUNCH

By G.L. Jasper and G.W. Batts

The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or nuclear energy activities or programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.



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